handled by the patient. There is some evidence that sensitivity to tulips and daffodils can at times be specific to one variety. Care must be taken to ensure that the plant concerned has no primary irritant effect on the skin. With the exception of the peel of the citrus fruits, which provokes a more severe reaction in some persons, the plants listed in Tables I and II rarely provoke more than slight erythema in non-sensitized individuals. Where plants whose irritant properties are unknown are employed for testing, control tests must be applied to normal persons. Patch tests must, of course, be postponed until the dermatitis has healed, and should always be applied to skin which has not been involved in the attack. The interscapular region is often suitable. The patches are removed after 48 hours and the tests are read then and again 48 hours later. A brisk eczematous response can be regarded as indicating allergic sensitivity; the evaluation of weaker responses requires care and experience.

Phytophotodermatitis

The diagnosis of phytophotodermatitis is usually simple. A bullous reaction to insect-bites is not uncommon on children's legs, but the tense hemispherical bullae, solitary or irregularly distributed, are quite unlike the pattern of linear bullae of phytophotodermatitis. Patch tests provide no useful information.

Treatment

Sensitization dermatitis is treated along the same lines as any eczematous reaction, with rest, sedation, and bland applications. In general the prevention of further attacks depends on avoidance of contact with the plant responsible, hence the importance of its identification. Desensitization has been attempted for a number of species, and promising progress is being made, but the results are at present uncertain. The patient whose livelihood depends on his handling the plant to which he is sensitive should be referred to a dermatologist, who can advise on the practicability of desensitization, although this is unfortunately seldom successful.

Phytophotodermatitis should be treated symptomatically by opening the blisters and applying an antibiotic ointment to prevent secondary infection.

Summary

The influence of changes in horticultural fashions and of the introduction and spread of foreign "weeds" on the patterns and incidence of plant dermatitis is summarized.

The varieties of plant dermatitis and their pathogenesis are described.

The nature of the antigenic substances in plants is discussed and the relationship between certain botanical features and capacity to induce dermatitis is emphasized.

The common causes of plant dermatitis in Britain are tabulated and clinical features, diagnosis, and treatment are reviewed.

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EFFECT OF SUXAMETHONIUM ON CARDIAC RHYTHM

BY

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Suxamethonium (succinylcholine) has been known to produce a bradycardia in infants and young children (Leigh *et al.*, 1957; Telford and Keats, 1957). Martin (1958) and Bullough (1959) have reported that repeated doses of suxamethonium caused not only a slowing of heart rate but also a disturbance of rhythm. It seemed important to confirm these findings, and to find out in greater detail whether this relaxant drug could cause—in clinical practice—a disturbance of rhythm sufficient to produce a circulatory collapse.

Method

An unselected group of 41 patients (31 females and 10 males) whose ages varied from 18 to 62 years, were given repeated doses of suxamethonium varying from 10 to 100 mg. and the effect upon the heart rate was recorded by an electrocardiograph. The first 36 patients of this series were premedicated with papaveretum 10 mg. and hyoscine 0.4 mg., while for the last five patients atropine 0.6 mg. was substituted for the hyoscine. Anaesthesia was induced with thiopentone and maintained with nitrous oxide (6 litres) and oxygen (2 litres) on a circle system, incorporating fresh soda-lime, via a facepiece. Additional doses of thiopentone and a single dose of pethidine (15–30 mg.) were given whenever necessary to maintain an even level of light anaesthesia. During the periods of paralysis controlled respiration with mild hyperventilation was employed. The electrocardiographic recordings were made with the standard lead II circuit (right arm and left leg) and all tracings completed before the operation was begun.

A control recording was first made; then the initial dose of suxamethonium was given, during a second recording. On the resumption of spontaneous respiration a further dose of the relaxant drug was given and another tracing recorded. This procedure was repeated for subsequent doses—all patients receiving at least five doses of suxamethonium. Fig. 1 shows graphically the recordings of such a sequence.

An attempt was made to determine whether the size of the initial dose of suxamethonium bore any relation to the incidence of bradycardia or arrhythmia.

Results

The effect upon the heart rate of varying doses of suxamethonium is shown in Table I. After the first dose of suxamethonium, irrespective of amount, there was often an increase in the heart rate; but in four instances a slowing of up to six beats a minute was observed. Of the 41 patients studied, 36 (88%) showed a slowing of the heart rate by the subsequent injections. This fall in heart rate did not necessarily follow the second injection, and might only appear after the fifth dose had been given.

TABLE I.—*Effect of Suxamethonium on Heart Rate*

Group	No. of Patients	First Five Doses		Response of Heart Rate
		Initial	Total	
A	11	100 mg. → 50 mg.	(×4)=300 mg.	Slowing 7, arrhythmia 4
B	5	100 ,, → 10 ,,	(×4)=140 ,,	Slowing 3, no change 2
C	5	25 ,, → 10 ,,	(×4)= 65 ,,	Slowing 2, no change 3
D	5	25 ,, → 50 ,,	(×4)=225 ,,	Slowing 4, arrhythmia 1
E	5	10 ,, →100 ,,	(×4)=410 ,,	Slowing 4, arrhythmia 1
F	5	100 ,, → 25 ,,	(×4)=200 ,,	Slowing 4, arrhythmia 1
G	5	100 ,, → 25 ,,	(×4)=200 ,,	Slowing 4, arrhythmia 1

A sinus bradycardia appeared in 28 patients (68%) and an arrhythmia of a variable nature was noted in 8 (20%).

In the five patients who failed to show any significant alteration of heart rate the subsequent injection of suxamethonium had never exceeded a 10-mg. dose. This suggests that the occurrence of bradycardia or arrhythmia was related to the size of the actual repeat dose used. This thesis is supported by the finding that three of these five patients exhibited either a bradycardia or an arrhythmia when a large additional dose was subsequently given. As a result of these additional doses the incidence percentages of slowing and arrhythmia varied as follows: of 41 patients, 39 (95%) showed a slowing. Of this slowing, 28 (68%) showed a sinus bradycardia and 11 (27%) showed an arrhythmia.

The results suggest that it is the size of each individual dose rather than the total dose of suxamethonium given that is important in causing this phenomenon (see Table II).

Nature of the Arrhythmia

The abnormalities found can be conveniently classified as a disturbance of auricular (P wave) and ventricular (QRS complex) function, together with interference with auricular and ventricular (A–V) conduction. The P wave may be decreased (Fig. 2), displaced (Fig. 3), or absent, as shown in Figs. 3, 6, and 8. The QRS complex may be widened (Fig. 4), or ectopic complexes may occur either singly (Fig. 5) or coupled (Fig. 6).

The abnormality of A–V conduction is best illustrated in the appearance of the Wenckebach phenomenon (Fig. 7) and in its dramatic form as ventricular standstill (Fig. 8). In this latter instance the period of cardiac arrest

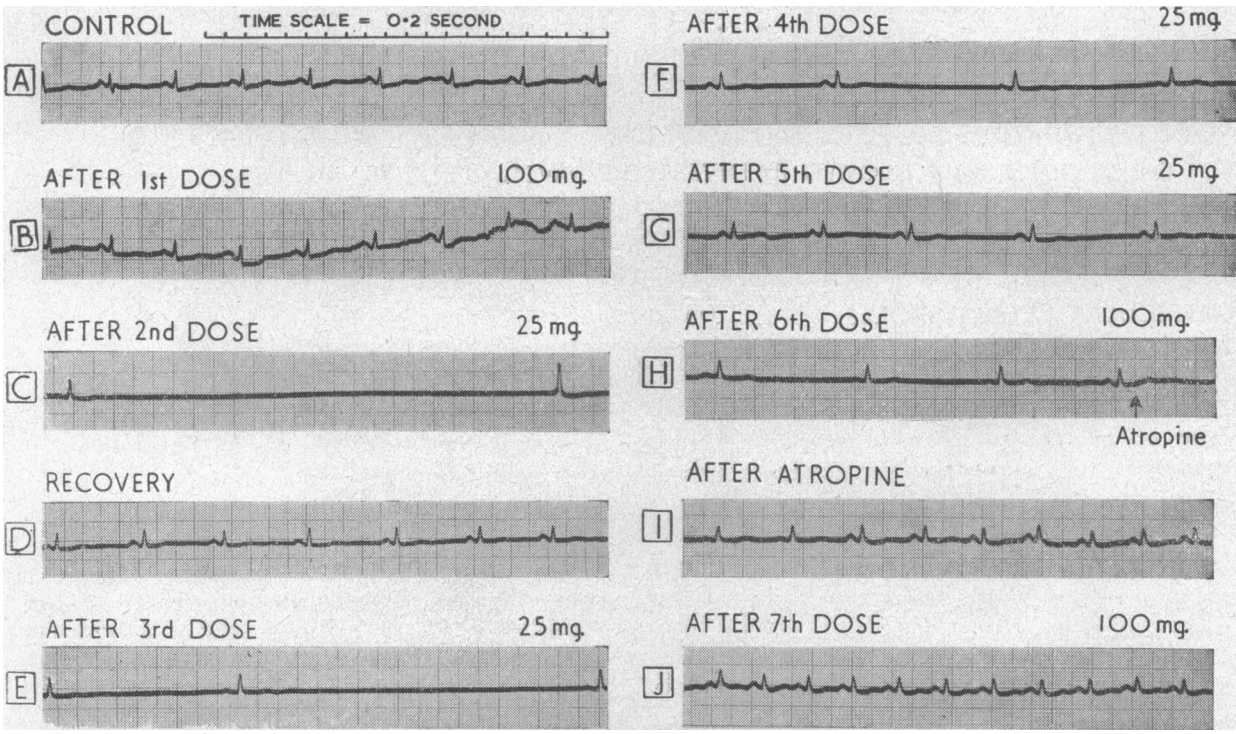


FIG. 1.—A–H. Effects of successive doses of suxamethonium taken approximately 20 to 30 seconds after injection. The slowing of the heart rate produced by 25 mg. steadily diminishes from second to fifth dose. Note resurgence of bradycardia when dose is increased to 100 mg. (H). I and J. Effect of atropine (tachycardia) and absence of slowing of heart rate after further 100 mg. of suxamethonium.

TABLE II.—*Dose-Effect Relationship of* 11 *Cases of Arrhythmia with Reference to Figures*

Dose Causing Arrhythmia	Size of Dose (mg.)	Total Amount Given at Max. Effect (mg.)	Effect	Fig.
Second ..	25	125	Displaced P waves. Ventricular standstill 4·9 sec.	1c
Third ..	25	150	Ventricular extrasystoles	5
Second ..	50	150	Displaced P waves. Ventricular standstill 4·4 sec.	—
Second ..	50	150	Coupled beats. ? ventricular extrasystoles. Ventricular standstill 3·5 sec.	6
Second ..	50	150	Displaced P waves	—
Third ..	50	200	Sinus arrhythmia, diminished P waves	2
Third ..	50	125	Wide QRS complexes followed immediately by inverted P waves	4
Fourth ..	100	310	Wenckebach's phenomenon. Complete A–V block. Ventricular standstill 5·4 sec.	7
Sixth ..	100	240	Displaced P waves. Ventricular standstill 7·0 sec.	8
Seventh ..	100	215	Displaced P waves. Ventricular standstill 3·6 sec.	—
Eighth ..	100	315	Displaced P waves. Ventricular standstill 3·0 sec.	3

Note: Only two recordings of ventricular standstill were photographed: they are shown in Figs. 1c and 8.

lasted seven seconds, though the general appearance of the patient remained unchanged.

An attempt was made to abolish the bradycardia and prevent its recurrence after a further dose of suxamethonium in five patients by the intravenous injection of 1 mg. of atropine sulphate. After this injection the heart rate invariably increased to more than 100 beats a minute, and the subsequent administration of even a large dose of suxamethonium produced no slowing or abnormality of rhythm (see Fig. 1).

Discussion

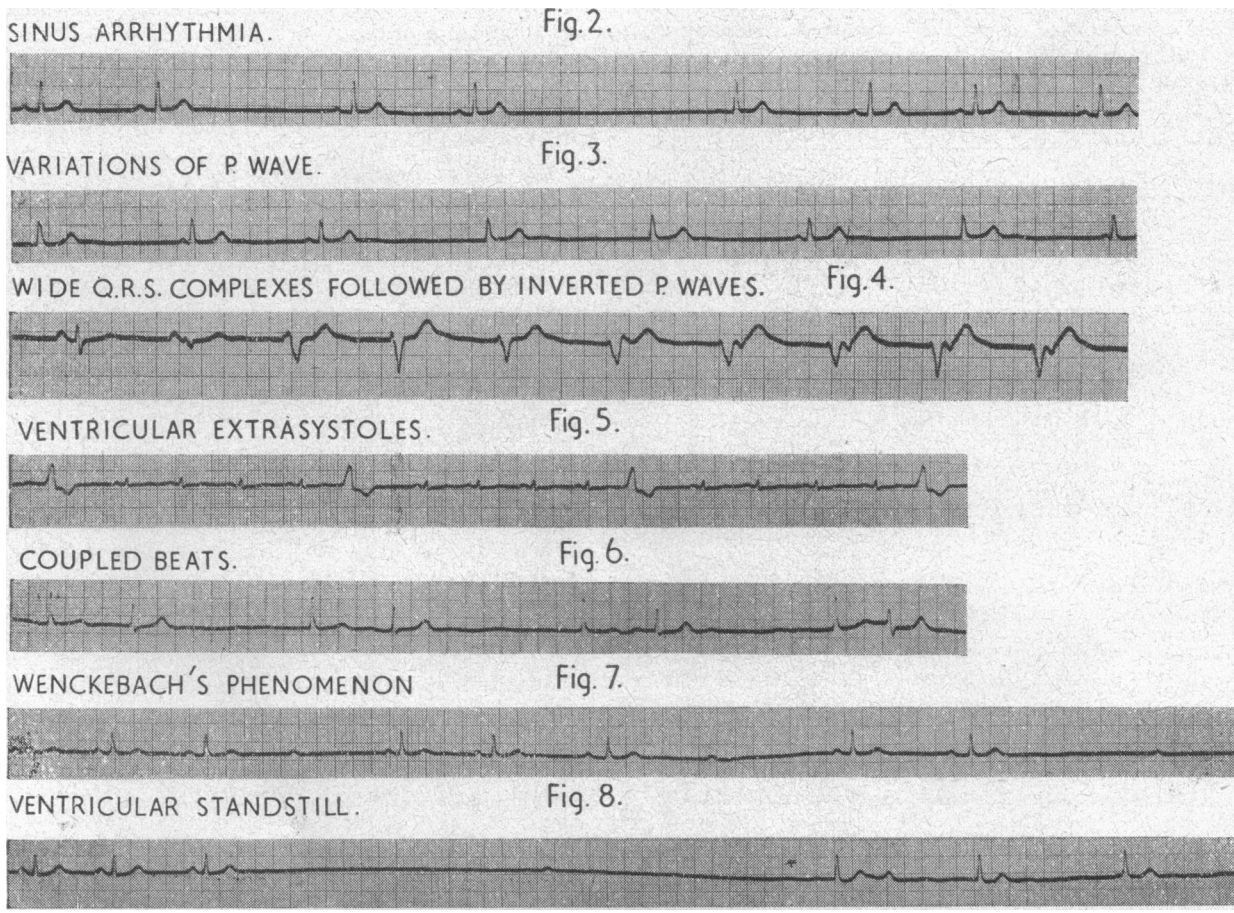
From these results it appears that cardiac disturbance is not related to the size of the initial dose, to the number of doses, or to the total dose given, but primarily depends upon the size of each individual *repeat* dose—because it has been shown that 25 mg. or larger successive doses of suxamethonium will produce either a sinus bradycardia or an arrhythmia.

Of the seven instances of ventricular standstill produced in this series, six occurred after a repeat dose of 50 mg. or more of suxamethonium had been given, and lasted from three to five and a half seconds. It is concluded that when 100 mg. of the drug has been given a further dose of 50 mg. or more may produce a ventricular standstill of three seconds or longer; but this is unlikely if the repeat dose is less than 50 mg.

The depression of excitation and conduction appears to result from increased vagal activity, and as intravenous atropine abolishes this depression and prevents its recurrence this supposition would seem to be corroborated.

The findings of this investigation are principally in agreement with those of Martin (1958) and Bullough (1959). These authors, however, claimed that the maximum slowing of the heart rate occurred on the second and third injections of suxamethonium and was rarely seen after subsequent doses. In this investigation the maximum bradycardia or arrhythmia was observed as late as the eighth injection provided the size of this particular dose exceeded that of its predecessors.

Verner and Comty (1959) reported that the subcutaneous injection of atropine (0.6 mg.) as part of the



FIGS. 2–8.—Instances of cardiac disturbance found in a series of 41 patients after use of suxamethonium.

premedication failed to prevent a slowing of the heart rate on the subsequent injection of suxamethonium. Similarly, the intravenous injection of 0.6 mg. of atropine also failed to afford protection. In this investigation, however, the intravenous administration of 1 mg. of atropine sulphate prevented the subsequent development of bradycardia or arrhythmia in every case, even when large doses of suxamethonium were used.

The clinical significance of these findings is that the intermittent use of large doses of suxamethonium—designed to produce prolonged muscular relaxation—may give rise to a dangerous arrhythmia. Although a proved fatality from this method has not yet been reported, these results suggest that were such a technique used for a patient with myocardial ischaemia a fatal outcome might arise. Furthermore, if it is necessary to give large doses of suxamethonium intermittently, it is recommended that a dose of atropine (1 mg. intravenously) should precede the second injection of suxamethonium.

Summary

A slowing of the heart rate was found in 39 of a series of 41 patients after repeated suxamethonium injections.

Electrocardiographic recordings showed this slowing was a sinus bradycardia in over two-thirds of the patients, with irregularities of rhythm occurring in the remainder.

The nature of this arrhythmia was a depression of excitation and conduction of the cardiac impulse which in its severest form produced a cardiac arrest of seven seconds.

The bradycardia or arrhythmia appears to be related to the size of the repeat dose used, and not to the number of doses or to the total amount of suxamethonium given.

Until further work has revealed the cause of these changes, atropine is suggested as a safeguard against these potentially dangerous effects.

We are indebted to Dr. Evan Jones for his reading and interpretation of the electrocardiographic tracings. We thank Professor J. B. Kinmonth and Mr. F. B. Cockett for kindly allowing us to investigate their patients, and Mr. T. W. Brandon for photographing the electrocardiographic tracings.

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An experiment in helping mentally handicapped men, women, and young people to lead normal working lives is to begin shortly in Northern Ireland. Twelve women and girls, aged 18 and over, will be taken out of special institutions, jobs will be found for them, and they will live in the ordinary community surroundings in a small hostel. The hostel will be in charge of a warden, who will be available to discuss personal problems that arise. The women and girls going into the first hostel are being transferred from special-care centres, where they have received expert training, and they will go out to work each day in the normal way. Some of them will work in local hospitals in the kitchens and laundries, and others may be placed in jobs with outside firms. If this experiment succeeds there will later be separate hostels for men.

EFFECTS OF EARLY AND LATE CLAMPING OF UMBILICAL CORD ON INFANT'S HAEMOGLOBIN LEVEL

BY

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This paper describes a controlled trial designed to compare the haemoglobin levels of infants whose umbilical cords were clamped immediately after birth with those whose cords were stripped and clamped later.

The objective was to determine whether there was any appreciable difference in haemoglobin values or in general well-being of the infants which could be ascribed to the timing of the clamping of the umbilical cord. This trial was one of the investigations conducted in order to study the reasons for the local prevalence of iron-deficiency anaemia in infancy and childhood (Lanzkowsky and McKenzie, 1959; Lanzkowsky, 1959, 1960a, 1960b).

Many workers have suggested that early clamping of the umbilical cord deprived the infant of blood from the foetal side of the placenta which would otherwise be pumped into the circulation of the infant by post-partum uterine contractions and that the deficit might be considerable, even as much as 215 ml. There is controversy about the quantity. If it were large it would mean a considerable reduction in the potential iron content of many newborn infants.

This subject can only be considered against a background of physiological and other factors.

Blood Volume of Newborn

There are several reports on total blood-volume determinations in neonates (Schücking, 1879; Lucas and Dearing, 1921; Bakwin and Rivkin, 1924; Robinow and Hamilton, 1940; Brines *et al.*, 1941; DeMarsh *et al.*, 1942; Mollison *et al.*, 1950). Brines *et al.* and DeMarsh *et al.* used the Evans blue method, and Mollison *et al.* employed isotopes in blood-volume estimations. The other authors used less reliable techniques—the perfusion method (Schücking) or the brilliant vital red dye method (Lucas and Dearing; Bakwin and Rivkin; Robinow and Hamilton). In the reports prior to that of Brines *et al.* (1941) the estimated blood volume of infants varied from 6.5% to 14.9% of the body weight. This wide discrepancy may be due in part to the unreliability of the method employed for volumetric estimation and in part to failure to consider the mode of handling and the time of clamping of the cord and the time of the estimation in relation to birth.

DeMarsh *et al.* (1942) estimated the blood volumes of 35 newborn infants. In 18 of these infants the umbilical cord was clamped immediately after birth. Blood-volume determinations were made between 15 minutes and 3 hours after birth, and on the third day of life. They obtained an average total blood volume of approximately 361 ml. between birth and the third day of life in infants receiving placental blood, and an average of 301 ml. in those infants deprived of it by early clamping of the cord. This indicates that infants

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