stration. In the dental cases the surgeon was able to complete the operation before the patient recovered consciousness. After recovery of consciousness and of reflexes, some drowsiness and giddiness often persisted for up to 10 minutes, and most patients required assistance in walking away from the dental chair. Nearly 10% of the cases vomited in the immediate post-anaesthetic period. None vomited during anaesthesia. The vomiting was very slight, being in most cases one single retch. The frequency was higher than is our experience with nitrous oxide and oxygen.

Conclusion

The Hingson inhaler is practical and efficient for short general anaesthesia for minor procedures. The method eliminates hypoxia due to deficiency of oxygen in the inhaled mixture. The method is effective and satisfactory for operations which can be completed within, say, five minutes. It seems to be of special value in two types of patients: firstly, for anyone in whom an episode of hypoxia is particularly dangerous, and, secondly, for robust and "resistant" patients in whom difficulty with nitrous oxide can be anticipated. The chief disadvantages of the method seem to be the slightly higher incidence of vomiting than with nitrous oxide and oxygen even when the latter is supplemented with trichloroethylene and the slightly longer time required for the patient to recover enough to be allowed to walk unaided.

Two points remain for emphatic reconfirmation: (1) That the mixture in the bag is in no circumstance flammable or explosive. For this we have the authority of Dr. Hingson and his colleagues working in consultation with the U.S. Bureau of Mines. (2) That cyclopropane administered in this fashion will carry no higher morbidity or mortality than nitrous oxide. Hingson (1958, personal communication) has already anaesthetized over 5,000 patients, while Bourne's (1958, personal communication) experience runs to 3,000.

It must be emphasized that the certainty of non-explosibility of the mixture lies in the use of the special cylinders supplied. We strongly discourage any attempt to make a non-flammable mixture of cyclopropane for routine clinical use by drawing it from a cylinder of pure gas.

Summary

Nitrous oxide may be a dangerous anaesthetic if attempts to deepen anaesthesia are accompanied by hypoxia. Cyclopropane is free from this danger because its potency allows higher proportions of oxygen to be used. The Hingson apparatus (the Western Reserve portable anaesthesia machine), which permits cyclopropane from special midget cylinders to be administered in non-explosive mixture with helium and oxygen, is described. The clinical results of this method in 100 cases were so good as to engender the hope that an apparatus of this sort will be more widely available for trial in this country.

We thank Dr. R. A. Hingson, professor of anaesthesiology, Western Reserve University, Cleveland, Ohio, for the loan of his apparatus and a liberal supply of midget cylinders; Dr. W. W. Mapleson, Ph.D., for his investigation of the performance of the soda-lime canister; Mr. R. J. Marshall, A.I.B.P., F.R.P.S., for the photograph; Mr. E. K. Hillard, L.I.B.S.T., for the drawings; Dr. A. D. Griffith, of Barry, for his clinical help; and our colleagues and various out-patient sisters for their co-operation.

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STREPTOMYCIN DERMATITIS IN NURSES

BY

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Sensitivity to streptomycin is very common. Since the first account by Heilman *et al.* (1954) a variety of dermatoses have been reported in patients treated with this antibiotic. The list includes pruritus, erythema, eczema, photosensitivity, urticaria, exfoliative dermatitis, and purpura. Occasionally the mucous membranes are affected, and cheilitis, stomatitis, and ulceration of the tongue have been described. Strauss and Warring (1947) reported an outbreak of dermatitis in nurses handling streptomycin, 4 out of 12 developing a rash on the hands and eyelids. Further reports (Rauchwerger *et al.*, 1948; Stringfellow, 1948; Wood, 1956) confirmed the fact that nurses giving streptomycin injections were liable to develop sensitivity to the drug.

Present Investigation

Over a period of eight years 14 cases of streptomycin dermatitis were seen among the nursing staff of one London hospital, two more were found during two years' observation at another London hospital, and two were referred from elsewhere. One subject was a male nurse; the remainder were females.

Clinical Features.—The sites most affected (Table I) were the sides and backs of the fingers, the backs of the hands, the forearms, the elbow flexures, and the face, par-

TABLE I.—*Sites Affected*

Case No.	Age at Onset	Hands	Arms	Eyelids	Cheeks	Neck	Legs
1	25	×	×		×	×	×
2	19			×			
3	19	×		×			
4	18		×	×		×	
5	24	×	×	×			
6	18	×	×		×		
7	18	×	×	×		×	
8	24	×	×				
9	19	×	×	×		×	×
10	21	×	×				
11	19	×					
12	36	×		×	×		
13	53	×	×	×			
14	46	×	×	×		×	
15	20	×					
16	21	×					
17	18	×					
18	27	×					

ticularly the eyelids (Fig. 1). Of the cases under investigation three had been so severely affected that they were obliged to give up nursing. One of these, however (Case 5), was able to resume after a course of desensitization. Details of her history are given below. Another was

FIG. 1.—Dermatitis of face with swelling of eyelids.

unable to follow her chosen occupation of district nurse in a rural area owing to inability to handle antibiotics, and the remainder had varying periods off duty as a result of their skin trouble. After the original dermatitis had subsided the skin often remained less tolerant of alkalis and other irritants than it had been before, and episodes of eczema on the hands and elbow flexures (Fig. 2) were not uncommon in the absence of further contact with streptomycin.

FIG. 2.—Persistent eczema of elbow flexures complicating streptomycin dermatitis.

Investigations.—

All cases were patch-tested against a 5% aqueous solution of streptomycin and penicillin, 1,000 units per ml. Positive patch reactions to streptomycin were given by all except the male nurse, who was negative on two separate occasions but gave a strongly positive intradermal reaction associated with a flare on the affected parts of the face and hands. Patch tests to penicillin were positive in one case, doubtful in another, and negative in the remainder.

Prognosis (Table II).—Once a nurse had acquired a high degree of sensitivity to streptomycin she could seldom handle the antibiotic again. One nurse, however (Case 4), lost her sensitivity two years after the onset of her rash, and another showed diminution of sensitivity, being able to withstand a limited amount of contact with streptomycin within two or three years of the onset of the rash. The remainder showed little alteration in sensitivity during the period under observation unless active steps had been taken to desensitize them.

Treatment

Prophylactic.—Of the total amount of streptomycin used in the hospital, between two-thirds and three-quarters was given in two wards where masks and gloves were invariably worn during injection of the antibiotic. In the

TABLE II.—*Prognosis Without Desensitization*

Case No.	Period of Observation	Persistent Rash on Streptomycin Contact	Remarks
1	5 years	+	Recurrent hand eczema. Gave up nursing owing to rash
2	4 "	+	Recurrent hand eczema
3	4 "	+	
4	3 "	—	Spontaneous "remission" after 2 years. Persistent rash on elbows
6	3 "	±	Partial remission after 18 months. Tolerates limited contact
8	4 "	+	
11	5 "	+	
13	2 "	+	Recurrent hand eczema
14	1 year	+	
15	1 "	+	
16	1 "	+	
17	4 months	+	
18	4 "	+	Gave up nursing owing to rash

course of eight years approximately 100,000 injections were given without a single case of dermatitis amongst the nursing staff. During the same period about 40,000 injections of streptomycin and 25,000 injections of "crystamycin" were given in the remainder of the hospital, where masks were not worn and gloves only very occasionally. Fourteen nurses contracted streptomycin dermatitis, and all but two of them admitted to having given antibiotics without wearing gloves or mask, and one of the two removed her gloves before washing the syringe.

Desensitization (Table III).—Wherever possible, the duties of a streptomycin-sensitive nurse were arranged so that she was able to avoid handling that substance. In six

TABLE III.—*Desensitization*

Case No.	Initial Dose	Final Dose	Length of Course	Patch Tests		Follow-up	End-Result
				Before Desensitization	After Desensitization		
<i>A. Streptomycin</i>							
5	2 μg.	1 g.	38 days	0.01%+	20%—	1½ years	Partial relapse after 1 year
7	10 μg.	1 g.	39 „	0.01%+	20%—	1½ „	Relapse after 1 year
8	10 μg.	1 g.	46 „	0.1%+	20%—	1½ „	No rash, handles antibiotics
9	5 μg.	1 g.	29 „	0.1%+	20%—	6 months 1½ years	„ „
10	10 μg.	1 g.	42 „	0.1%+	20%—		„ „
12	10 μg.	40 μg.	6 „	0.01%+			Abandoned owing to reaction
	10 μg.	1 g.	24 „	0.1%+	20%—	3 „	No rash
<i>B. Procaine</i>							
12	0.25 μg.	0.5g.	41 „	2%+	10%—	2½ years	Handles procaine penicillin. No rash

cases this was not practicable and desensitization was attempted. The cases chosen included one nurse who had been forced to give up nursing owing to her sensitivity, and the district nurse mentioned above. Before attempting desensitization they were patch-tested against serial dilutions of streptomycin, and all gave positive reactions to 0.1%, while three of them also reacted to a dilution of 0.01%. Desensitization was attempted by giving increasing doses of streptomycin on the lines advocated by Crofton (1953). An initial subcutaneous injection of 10 µg. was followed by an intramuscular injection of 10 µg. the next day. The initial dose was later reduced to 5 µg., and on one occasion to 2 µg., as it was found that reactions occasionally followed a first dose of 10 µg. Daily intramuscular injections were then given, each dose being approximately 50% higher than the dose of the previous day. The final injection of 1 g. was reached after about 30 to 40 days.

Reactions

Some cutaneous reaction was usual. In Case 12 this occurred on the third day after a dose of 20 µg., and

became so severe that desensitization had to be abandoned after six days, when a dose of only 40 μ g. had been reached. Three months later the same patient was successfully desensitized, although there were reactions causing erythema and oedema of the face after doses of 10 and 20 μ g. and again after 40 and 70 μ g. The remaining five nurses all developed an eczematous rash before a dose of 1 mg. had been reached, and in three cases similar reactions occurred to higher doses. Two nurses also showed transient urticaria during the course of injections, and another suffered an attack of headache and malaise. Case 12 was also successfully desensitized to procaine with only a transient skin reaction on the arms, although she suffered a short syncopal attack after the last injection in the course.

It was found by experience that mild reactions could be ignored and more severe ones treated either by keeping the dose stationary until the reaction had subsided or by stopping injections for a few days and then starting with a lower dose and raising the dose as before.

On completion of the course the patients were again patch-tested, and all were negative to a 20% aqueous solution of streptomycin. They were encouraged to give injections of streptomycin as soon as desensitization was completed, but advised to wear rubber gloves when doing so.

Two cases relapsed after a year, relapse being partial in one and complete in the other. The nurse who suffered a complete relapse was, however, protected against streptomycin for long enough to allow her to complete her training and take up work which did not involve contact with antibiotics. The other patient had given up nursing owing to her streptomycin sensitivity. After desensitization she was able to return to nursing and wrote to say that she could give an occasional injection of streptomycin without trouble, but developed "erythema and urticaria" if she worked on a tuberculosis ward where she was continually in contact with it. Further desensitization was not attempted in either case.

Case 3

A student nurse aged 19 was first seen on July 16, 1952, because of swelling of both eyelids and dermatitis of the fingers of both hands. Patch tests to streptomycin 5% were strongly positive, and to penicillin 1,000 units/ml. negative. Two weeks later the blepharitis subsided but the rash on the fingers continued. In August there was an exacerbation of the rash after giving an injection of streptomycin while wearing gloves. In September there was a rash on the face attributed to exposure to sunlight. In October and November the rash on the hands became more severe, and it was found that she was using a detergent to clean a sink in the ward. When the hands were kept dry the dermatitis gradually subsided.

In 1953 she left the hospital and was not seen again. In June, 1956, she wrote to say she still had recurrences of the rash on the hands, but that they were not severe and were kept in check by the use of a hand-cream. She gave no injections of antibiotics, but if she touched the syringes used for this purpose she developed a rash on the hands within a few hours.

Case 4

A student nurse aged 18 was first seen on July 16, 1952. She had been accustomed to give streptomycin injections without wearing gloves, and three days previously had developed an acute dermatitis on the face, the sides of the neck, and the elbow flexures. She had never before had any skin trouble nor asthma. In the next four days the rash spread extensively over the face, the trunk, and the forearms. She was admitted to hospital for a week and the rash settled down.

In December, 1952, there was a recurrence on the elbow flexures which was apparently unconnected with any direct contact with streptomycin. This cleared in about two months but relapsed again in October, 1953, when it persisted until the end of the year, but improved after superficial x-ray therapy.

In February, 1954, a further relapse involved the arms and the eyelids, coinciding with a period when streptomycin was being used extensively on the ward, although she was not herself giving injections. She was patch-tested to serial dilutions of streptomycin from 5 to 0.5% and gave strongly positive reactions to all of them (Fig. 3). The blepharitis cleared in a few days, but the rash on the elbow flexures did not clear for two months and relapsed a few months later. This particular eruption was regarded as an eczema sequel, and the episodes coincided with periods of emotional stress and not with streptomycin contact. Between September and November, 1954, she worked at another hospital, and although she came into contact with streptomycin and even handled a streptomycin spray her skin remained clear. On returning to her original hospital there was a recurrence of the rash on the eyelids and elbow flexures, but this settled in about a month. Her skin has since remained clear.

FIG. 3.—Case 4. Serial patch tests to streptomycin 5% (top), 2.5%, 1%, and 0.5%.

In June, 1956, she was again patch-tested to 5% streptomycin. There was no reaction after 48 hours, and only a faint erythema was visible at 96 hours. It would appear, therefore, that this nurse spontaneously lost her sensitivity to streptomycin.

Case 5

A student nurse aged 24 when first seen on August 22, 1952, complained of a rash on the fingers, arms, and face during the previous three days. She had been in contact with streptomycin for six months, wore gloves for giving injections, but took them off when washing out the syringe. The initial rash cleared in a few days, but on November 3 she was admitted to the wards for 10 days with a severe recurrence on the hands. On December 3 a patch test to streptomycin 5% was negative, but the reaction was strongly positive when she was retested on December 31. Patch tests to penicillin 1,000 units/ml. were negative. In January, 1953, the skin was clear. She was not seen again until February, 1955, when she wrote to say that she had given up nursing in 1953 owing to the rash and was now anxious to be desensitized. She stated that her dermatitis cleared soon after giving up nursing but that she still got a rash on the fingers when handling irritants which had previously been tolerated.

On March 4, 1955, she was tested against serial dilutions of streptomycin and gave positive reactions to 2.5%, 1%, and 0.1%, but was negative to 0.01%.

Desensitization was started on March 21 with an intradermal dose of 2 μ g., followed by a subcutaneous dose of 5 μ g. and, the next day, 5 μ g. intramuscularly. Daily intramuscular injections were given in increasing doses—20 μ g. on March 23 and 750 μ g. on March 30. A mild reaction occurred on the eyelids, wrists, and elbows, but desensitization was continued and a dose of 75 mg. was given on April 13. This was followed by mild dermographism which persisted until the end of the course, although relieved by antihistaminics. No further incident occurred, and desensitization was completed with a dose of 1 g. on April 22.

On April 27 patch tests to streptomycin 20%, 10%, and 5% were all negative, and she was able to resume nursing, wearing gloves when injecting antibiotics. A year later

there was a partial relapse. She was able to continue nursing and give injections of streptomycin and penicillin but developed urticaria and erythema when working in a tuberculosis ward where most of the patients were being treated with streptomycin. She was moved to a general ward in 1956 and has remained well since then.

Case 12

A district nurse aged 36 was first seen in March, 1955. Three and a half years previously she had noticed a rash on the face. This quickly cleared, but it recurred two months later, when it spread more widely and caused swelling of the eyelids. She was away from work for two weeks, and during this time the rash cleared, but it recurred three days after resumption of work. The second attack was more severe than the original one and there was considerable oedema of the eyelids, with exudation of the skin around the eyes. The rash continued to recur intermittently for the next year, and towards the end of that year was complicated by boils and styes. The following year she was instructed not to handle penicillin or streptomycin and had not done so between 1953 and 1955. As a result, however, her efficiency was so severely hampered that she wished to know whether desensitization would be possible in her case.

She was patch-tested against streptomycin and penicillin and gave a positive reaction to streptomycin 5%. She was then tested to a series of dilutions from 1 to 0.001% and gave positive reactions to all of them. Patch tests to penicillin 1,000 units/ml. were negative. Desensitization was attempted with an initial dose of 10 µg. on April 7, 1955, and 20 µg. on the following day. The next day there was some redness and itching on the fingers, and a further dose of 20 µg. was given. On April 11 she was given a further 20 µg. and again there was a reaction on the fingers. When given 40 µg. the next day a fairly severe reaction caused erythema of the face and oedema of the eyelids. This became more pronounced during the next two days in spite of cortisone 25 mg. six-hourly, and it was considered advisable to stop desensitization.

The reaction subsided in the course of the next few days, and as she insisted that it would be impossible for her to obtain work as a district nurse without being desensitized it was decided to admit her to hospital and attempt desensitization once more.

When admitted on June 14, 1955, she gave a positive patch reaction of streptomycin 1% and 0.1%. On June 18, desensitization was started with 10 µg. subcutaneously. Next day she was given 10 µg. intramuscularly, and desensitization proceeded with 10, 15, 15, and 20 µg. on successive days. As there was no reaction she was given twice-daily injections reaching 100 µg. on the sixth day and 1 mg. on the tenth day. There was a slight reaction on the fingers and chin after this, but injections were continued as before until there was a more severe reaction following 10 mg. Injections were then given daily up to 70 mg., when there was a considerable reaction. This subsided fairly quickly and the course was completed with twice-daily injections of 100, 150, 200, 300, 500, 750 mg., and 1 g. in the course of four days. The whole course took 24 days.

On July 13 a patch test against streptomycin 20% was negative. In August there was a recurrence of the rash on the face but patch tests to streptomycin 5% were negative, and when she gave the two antibiotics separately it was found that a reaction occurred when handling penicillin but not streptomycin. Both patch tests and intradermal tests to penicillin remained, however, consistently negative, but when tested in October against three brands of procaine penicillin she gave positive reactions to all of them and a strongly positive reaction to procaine 2%. It was therefore decided to attempt desensitization against procaine, and this was done, following approximately the same pattern as the streptomycin desensitization. An initial dose of 0.25 ml. of procaine 1 in 1,000,000 was given subcutaneously, followed by the same dose intramuscularly the next day. Daily intramuscular injections were given, the dose being

raised initially by 50%; later, as no signs of intolerance occurred, the dose was doubled each day. A slight reaction with itching and erythema of the arms followed a dose of 0.5 ml. of 1 in 10 solution of procaine, but it was possible to continue increasing the strength of the injection up to 5 ml. of a 1 in 10 solution of procaine. The last injection was followed by a transient syncopal attack.

Desensitization had taken 41 days. On December 16 she was negative to a patch test of 10% procaine, and shortly afterwards resumed work as a district nurse. Thirty months later she reported that she was giving regular injections of streptomycin, penicillin, and procaine, and had had no recurrence of her rash.

Discussion

A report from the Ministry of Health (1953) states that nurses have become sensitive to antibiotics in spite of strict adherence to careful technique and the wearing of gloves, gowns, and masks. During the period of observation, however, over 100,000 injections of streptomycin were given in two wards by nurses wearing gloves and masks without the occurrence of a single case of dermatitis among the nursing staff.

Where these precautions were not strictly observed the incidence was approximately 1 case per 4,000 injections. I consider, therefore, that streptomycin dermatitis in nurses could be reduced to a minimum either by the wearing of gloves and masks before giving injections or by adopting a "no touch" technique, using cartridges as described by Howells (1956). Most chest physicians adopt these precautions as a routine measure. In general wards, however, where streptomycin is used spasmodically, the dangers of dermatitis are not fully appreciated and insufficient care is taken when handling the drug.

In suspected cases the diagnosis should be confirmed by patch-testing or by the intradermal injection of streptomycin where patch tests are negative, as happened once in the present series. When sensitization has occurred it usually persists, although some degree of tolerance may arise in an occasional case. If possible, therefore, the streptomycin-sensitive nurse should be given work where she will not come into contact with this antibiotic. Where this cannot be done desensitization should be considered. This is a tedious procedure and not without risk. It is definitely unsafe in inexperienced hands, as most cases develop a reaction at some stage in the course. Corticosteroid cover (Pines, 1957) or the use of repeated minute doses in place of the conventional method (Morris-Owen, 1956) may reduce these reactions but are unlikely to eliminate them altogether. They are occasionally frightening, and persistent vestibular damage has been reported following a single injection of 100 µg. (Cohen and Glinsky, 1951).

In the present series desensitization was successful in the six cases in which it was attempted, but after a year one of these relapsed partially and the other completely. The nurse who suffered partial relapse was, however, able to resume nursing in general wards after desensitization, and the other was able to complete her training and then take up work which did not involve contact with antibiotics. Both had previously been incapacitated as a result of the rash.

Summary

Eighteen cases of dermatitis in nurses handling streptomycin are reported, the incidence being approximately 1 case per 4,000 injections.

No cases occurred in two wards where gloves and a mask were invariably worn while injections were given.

Six nurses were successfully desensitized, with a relapse in one case and partial relapse in another.

One nurse was also desensitized against procaine.

I am grateful to the matron of the Central Middlesex Hospital and to Dr. C. H. C. Toussaint for supplying me with information

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NEONATAL TETANUS IN NIGERIA*

BY

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Between April, 1953, and August, 1956, 141 cases of tetanus in newborn babies were treated in the children's department of University College Hospital, Ibadan, then in the Adeoyo Hospital. This disease is rare under modern conditions, and few series have been published which are large enough to permit statistical analysis, the largest being that of Loh Siew Gek (1951), who reported 174 patients from Singapore.

The mode of infection was described by Jelliffe (1950). The cord is cut at birth, often with a sharp stick or palm leaf, and is then dressed with a variety of unsterile materials, including clay, salt, shea-butter, a mixture of gin and palm oil, and "native medicine" which may contain cowdung. Finally a hot fomentation is applied.

The newborn baby has no immunity to tetanus (Cooke *et al.*, 1948), for even if the mother has previously had tetanus the amount of toxin absorbed in non-fatal tetanus is too small to provide an effective stimulus to antitoxin production (Cooke and Jones, 1943). A case occurred in this hospital in which a woman went into labour while suffering from tetanus. The baby was unaffected (D. D. Johnstone, 1956, personal communication).

Seasonal incidence of neonatal tetanus during the two-year period from June 1, 1954, to May 31, 1956.

Seasonal Incidence and Mortality

The incidence of neonatal tetanus during the two-year period June 1, 1954, to May 31, 1956, is shown in the Chart. The incidence is lower during the wet season (June to October) than during the dry period, averaging 3 cases a month for the wet season and 4.6 a month for the dry.

The mortality is shown in Table I. The results reported by other writers are set out in Table II. The sex incidence and mortality are shown in Table III.

TABLE I.—Mortality

Total No. of patients	141
Removed against advice	6
Recovered	14
Mortality in completed cases	89.6%

TABLE II.—Mortality in Other Series

Author	Place	No. of Patients	Mortality
Vinnard (1945)	New Orleans	11	55%
Jelliffe (1950)	Ibadan	25	96%
Friedlander (1951)	Durban	8	75%
Loh Siew Gek (1951)	Singapore	174	91%
Kao Yung-En (1951)	China	6	0%
Spivey <i>et al.</i> (1953)	U.S.A.	26	77%
Klenerman and Scragg (1955)	S. Africa	4	25%

TABLE III.—Sex Incidence and Mortality

	Male	Female
No. of patients	78	56
Recovered	10	4
Mortality	87.2%	92.5%

The mortality in the two sexes is not significantly different. $\chi^2=1.1$, $P=0.30$. The 6 patients removed against advice and 1 patient whose sex was not recorded are excluded.

Incubation Period

It may reasonably be assumed that, in neonatal tetanus, infection takes place soon after birth, and that the age of the patient at the time of onset represents the incubation period, although infection of the umbilicus can no doubt occur at any time before it is healed.

According to this assumption the incubation period was known for 135 patients, in whom it averaged 7.7 days. For the 14 who recovered the mean was 10.7 days, with a range of 6.5 to 20 days; for the 121 who died the mean was 7.3 days and the range 3 to 15 days.

Fifty-five patients had incubation periods of more than seven days, and 42 (76.4%) of them died. Among 80 patients with incubation periods of 7 days or less there were 79 deaths (98.7%). If the numbers of deaths in these two groups are compared, $\chi^2=18.0$, $P<0.01$, a very significant difference.

Similarly, among 16 patients with incubation periods of more than 10 days there were seven deaths (43.7%), whereas 119 patients with incubation periods of 10 days or less showed 114 deaths (95.8%). If these groups are compared, $\chi^2=41.0$, $P<0.01$.

Hines (1930) collected the records of 21 patients who recovered and found that the mean age at onset was 7.9 days, with a range of 5 to 14 days, whereas the 25 who died had a mean age at onset of 6.9 days and a range of 3 to 10 days. In Spivey, Grulee, and Hickman's (1953) series the mean age at onset of the six patients who recovered was 8 days (range 6 to 9 days), but for the 20 who died it was 6 days (range 4 to 9 days). Only one baby died among those whose incubation period was more than 7 days, and only one recovered among those in whom it was 7 days or less. Klenerman and Scragg's (1955) three patients who recovered had incubation periods of 4, 6, and 6 days.

Onset Interval

The onset interval is the period which elapses between the appearance of the first symptom, usually failure to suck, and the onset of tetanic spasms. Cole (1938, 1940) first drew attention to its prognostic importance when he found that the case mortality in tetanus varied inversely with the duration of the onset interval.

It was not easy to estimate the onset interval in these patients because of the uneducated African's vague sense of time, but a tentative estimate could be made in 42 cases, and the results are shown in Table IV.

The 36 patients who died had a mean onset interval of 0.9 days, the 6 who recovered a mean of 3.6 days. If the number of patients having an onset interval of 24 hours

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