

An Analysis of  
Forty one Cases.  
of  
Tetanus.

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## An Analysis of Forty-one cases of Tetanus.

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For the data of this thesis, I have taken the records of the 41 cases of Tetanus, admitted to the wards of the Barbados General Hospital in the years 1900 and 1901, during my term of office as Resident Surgeon.

The patients were either black or coloured, and were drawn from a population of about 40,000 who reside in the town and district near the hospital.

For the sake of easy reference, a tabulated statement is given on the next pages, of the age, cause, condition on admission, treatment, &c of each patient: under the head "Condition on admission" crosses are employed to illustrate the relative amount of rigidity of jaws, abdomen, opisthotonos, as well as the relative strength or frequency of the spasms.

Let us first consider the



Number	Sex	Age	Occupation	Cause	Age of wound if any	Duration of illness before admission	Length of stay in Hospital
1	f	29	lab	0		5 days	4 days
2	f	60	lab	wnd: of foot	7 days	1	6
3	m	28	lab	0		3	11
4	m	69	lab	0		1	12
5	m	18	lab	0		4	84
6	m	11	lab	wnd of heel	16	14	9
7	m	49	lab	0		4	12
8	f	17	lab	0		1	7
9	f	49	laundress	0		4	11
10	f	16	lab	chiggers		4	8
11	m	52	lab	wnd of foot	14	7	2
12	f	4	school	wnd of foot	8	1	2
13	m	42	lab	0		2	1
14	m	45	lab	wnd of foot	4	2	35 minutes
15	f	20	cook	wnd of foot	7	2	6 days
16	f	11	school	0		2	2
17	m	17	groom	0		4	10 hours
18	f	45	cook	wnd of finger	7	4	3 days
19	m	32	lab	0		11	2
20	m	60	lab	0		3	6
21	m	55	cooper	wnd of foot	3	1	4

On Admission Temperature						Treatment	Result
rigidity of jaws	rigidity of abdomen	spasms	Opisthotonos	on admission	Highest recd		
x	xx			98	100	Bromide + Chloral	death
x	x			99		Bromide + Chloral	"
xx	xx	x	x	99	102.8	Morphia Bromide + Chloral	"
xx	xx	x		99.2	104	Morphia Bromide + Chloral	"
xx	xx	x	x	99	99.4	Bromide + Chloral	cured
x	xx			98.4	105	Bromide + Chloral	death
xx	xx	x	x	98.7	100	Bromide + Chloral	"
x	x			100		Bromide + Chloral	"
xx	xx			98.6	101	Bromide + Chloral	"
xx	xx	xx	x	99	106.4	Carbolic acid	"
xx	xx	x	x	100	100	Carbolic acid Morphia	"
xx	xx	xx	x	99.4	104.2	Carbolic acid	"
xxx	xx	xx	x	104	106	Morphia Bromide + Chloral	"
xxx	xxx	xxx	xxx		106	Morphia Chloroform	"
xx	xx			98.4	102.4	Bromide + Chloral	"
xxx	xxx	xx	xx	101.2	103	Morphia Bromide + Chloral	"
xxx	xxx	xxx	xx	99.2	100	Morphia	"
xx	xx	x	x	102.2	106.6	Bromide + Chloral	"
xx	xx	xx	x	98.4	100	Morphia + Chloral	"
xx	xx	x	x	99	102	Morphia Bromide of Soda	"
x	xx			99.6	103.4	Bromide + Chloral	"

Year	Cases	Deaths.
1875	9	8
1876	7	7
1877	9	8
1878	13	13
1879	15	13
1880	16	8
1881	21	8
1882	11	2
1883	12	4
1884	8	6
1885	7	7
1886	14	13
1887	28	19
1888	30	15
1889	25	17
1890	20	15
1891	33	22
1892	20	11
1893	13	13
1894	17	13
1895	4	4
1896	11	5
1897	23	14
1898	21	18
1899	24	21

## Mortality and Incidence

During 1900, there were 21 cases with one recovery, while for 1901, there were 20 cases with six recoveries.

It is of interest to compare these figures with those for the past twenty-five years given on the opposite page. During that time (1875 - 1899) there were 411 cases with 284 deaths, giving us a yearly average of about 16 cases with 11 deaths, that is a mortality of 69%; so that while the mortality for 1901 was 70%, almost the same, in fact, that for 1900 was far in excess, viz: 96%.

Why the different years should show such disparity of results probably depends on some unknown factor or factors, such as atmospheric conditions, or the condition of the soil, which in some way modify the virulence of the Tetanus bacillus. It would be difficult on other grounds, looking to the similarity of treatment and condition on admission, to explain the series of 29 consecutive deaths (nos 6 to 34), and the almost

consecutive series of 6 recoveries in the latter months of 1901, for, assuming that the result depends on the amount of the poison introduced, it is too much of a coincidence for the last 6 cases to have taken up less than the preceding 29, whether the surface of inoculation be gross or unascertained.

Contributing to the high mortality is the necessity of having to carry out treatment in the general wards; such isolation as is afforded by hanging a curtain around the bed and plugging the ears with cotton wool is all that we have at our command, consequently the patient is subjected to much noise and irritation, and the chances of recovery are prejudiced.

The patients, too, are not ready in availing themselves of early treatment. The majority are under no apprehension as to the nature of their illness till "lock jaw" is marked, or spasms supervene.

Of the above cases, 9 only came to hospital within twenty-four hours of

the first sign of stiffness.

### Sex Distribution, Age + Occupation

One would expect that males would much oftener be the victims of Tetanus than females, but, in the above series of cases, of the 14 wound infected cases 6 were females, while of the 22 cases where no wound was found 11 were females.

The ages ran from 4 years (no 12) to 69 (no 4).

More than half, twenty-five, were by occupation agricultural labourers. Six were children at school, three were laundresses, two were cooks, two were groomers, the remaining three being mechanics.

### Cause

Working barefooted, the negroes are exposed to all sorts of wounds and scratches, and the practice of applying earth or cobweb to arrest haemorrhage is a very common one among them.

Often this is the only dressing, and, as in a climate such as this, healing is rapid, by the time the bacillus of Tetanus

has passed through its incubation stage the body may be searched in vain for its point of entrance. Therefore one hesitates to accept as examples of idiopathic Tetanus the 22 of the above cases in whom no wound was detected.

In one, (no 40), no external wound was found but 13 round worms (*ascaris lumbricoides*) were passed after the administration of Santonin. After a very severe illness, an account of which is given later, she recovered.

Chiggers are a not uncommon source of infection: four of the cases were thus infected. Of these two recovered.

Definite wounds of the hands and feet were found in 14 cases, and of these none recovered. Wounds of the foot were almost four times as prolific of Tetanus as wounds of the hand, there being 11 with wounds in the foot to 3 with wounds in the hand.

These wounds were all punctured or lacerated. Case 14, the most aggravated of the series, was wounded by the sharp

Spike of a plant on the dorsum of the left foot, four days before stiffness set in. The wound bled but little at the time, so was ignored; on admission, it was sending a thin watery pus. Notwithstanding a hypodermic injection of Acetate of Morphine gr $\bar{u}$ , and the free administration of Chloroform, spasm followed spasm with extreme rapidity, till, finally, the muscles of respiration and the diaphragm became involved. Breathing ceased abruptly, the heart's action ceased immediately after, death occurring 35 minutes after he was brought in.

Case 18, a cook came to hospital with a fish bone broken off in the left index finger. This was removed and the wound dressed daily with carbolic fomentation. She ceased attending hospital at the end of a week, but, four days after, was brought in with Tetanus. This has been the only case where Tetanus followed on in a wound which had been surgically dressed from the first.

### Incubation Period

If we may reckon from the date of injury to the earliest period of stiffness, in those cases of traumatically proved origin in the above series, the incubation period will be found to average 11 days. The shortest period noted was 3 days, (no 21), while the longest was 28 days. (no 25).

### Prognosis

Osler, in his chapter on Tetanus, (p. 182, second edition) refers to two of the Hippocratic Aphorisms as tersely expressing the general prognosis even at the present day. As regards the first, "The spasm supervening on a wound is fatal", it is thoroughly borne out, as none of the "wound" cases recovered. The second Aphorism, "such persons as are seized with Tetanus die within four days, or, if they pass these, they recover", does not hold good to the same extent. No less than 16 out of the 34 who died lived more than four days after admission to hospital. In fact, the average duration of life after admission to hospital, of the cases which

ended fatally, was  $5\frac{1}{2}$  days. If we take into account the duration of illness before being brought to hospital, we find that only 7 failed to survive four days. As a general rule, local experience shows that if the patient survive the first fortnight, and the spasms and rigidity can be held in check, prognosis is favourable. After three weeks prognosis is good. Of the eight who survived the first fortnight, seven recovered. The one case that did not conform to this rule was no 32. The most disappointing case in the series. The following is a brief outline of the history -

Receiving a wound on the sole of the foot, he had tied it up with a rag and trusted to its healing. On the 15<sup>th</sup> day he noticed some stiffness in the jaws and tightness in the epigastrium. He was admitted to hospital, the wound was freely laid open, and carbolic poultices applied. He grew worse rapidly, and for nearly two weeks was in a critical state. During the third week, the spasms

and opisthotonos left him, and he could open his jaws moderately widely, but there was still strong resistance to pressure on the abdomen. On the 31<sup>st</sup> day the recti were distinctly harder, and it was more difficult for him to separate his jaws. On the 32<sup>nd</sup> day, a small abscess pointed on the dorsum of the foot, which was opened and carbolic poultices applied.

That night he had a spasm, and next day two or three. The temperature, too, which had been 99 throughout, ran up to 101. On the forenoon of the 35<sup>th</sup> day he died of exhaustion.

#### Condition on Admission

In all of the cases, by the time the patients came under observation, the rigidity had spread from the muscles of the jaw and neck to the muscles of the abdomen. Even in the 9 cases who came within 24 hours this was the case. In 5 of them, (viz 2. 8. 21. 28. 32) the rigidity had not yet extended to the muscles of the back, so that probably the abdominal muscles are affected next

in order before the extensor muscles of the back become involved. Thus, opisthotonos was present in only 26 of the 41 cases, on admission: 29 had spasms. Case 39 was peculiar in so far that she alone of the series, had no spasms during the course of her illness.

With reference to the rigidity of the jaws and abdomen, it was noticed that in several, viz (nos 1, 6, 21, 22, 26, 28, 31, 38, 41) the rigidity of the abdomen was more marked than that of the jaws. For the most part, the relative rigidity in each was proportionate, that is, when the jaws could be moderately separated, the rigidity of the abdomen was moderate only in amount, when the one was slight the other was slight, and so on. Certainly, as a guide to progress during the illness, more reliance was to be placed on the rigidity of the abdomen than on that of the jaws. This was noted again and again, as in case 32 outlined above.

Even when the patient is so far well as to be able to sit up in bed, there is usually

a sense of resistance conveyed to the hand when the epigastrium is palpated.

With regard to the general condition of the patient, it is remarkable how little the different systems are affected by Tetanus. Generally speaking, the heart's action is not accelerated; even during the spasms the action is not so quick as one would expect. When the case is nearing a fatal termination the pulse may grow faster and weaker, and, of course, the same alteration may be noted when large doses of Chloral are given or continued for long.

The Respiratory System appears to be as little affected, except the muscles of respiration are involved, as in case 14.

Occasionally an erythematous rash may occur on the face & hands, (as in cases 36 and 40) but as in each of these it appeared at a late stage, it may be a chloral rash.

In none of the cases was the urinary system affected. There was no retention or incontinence - no haematuria or

### albuminuria.

There was no interference with digestion, and, as a rule, the bowels were opened daily without medicine. Occasionally a dose of salts was indicated, and was sufficiently drastic even for the worst cases.

Cerebral and mental functions were good: intelligence was generally acute: Sleeplessness was never complained of even in those cases who were not put on Bromide & Chloral: delirium was present in only one case, no 40.

### Temperature

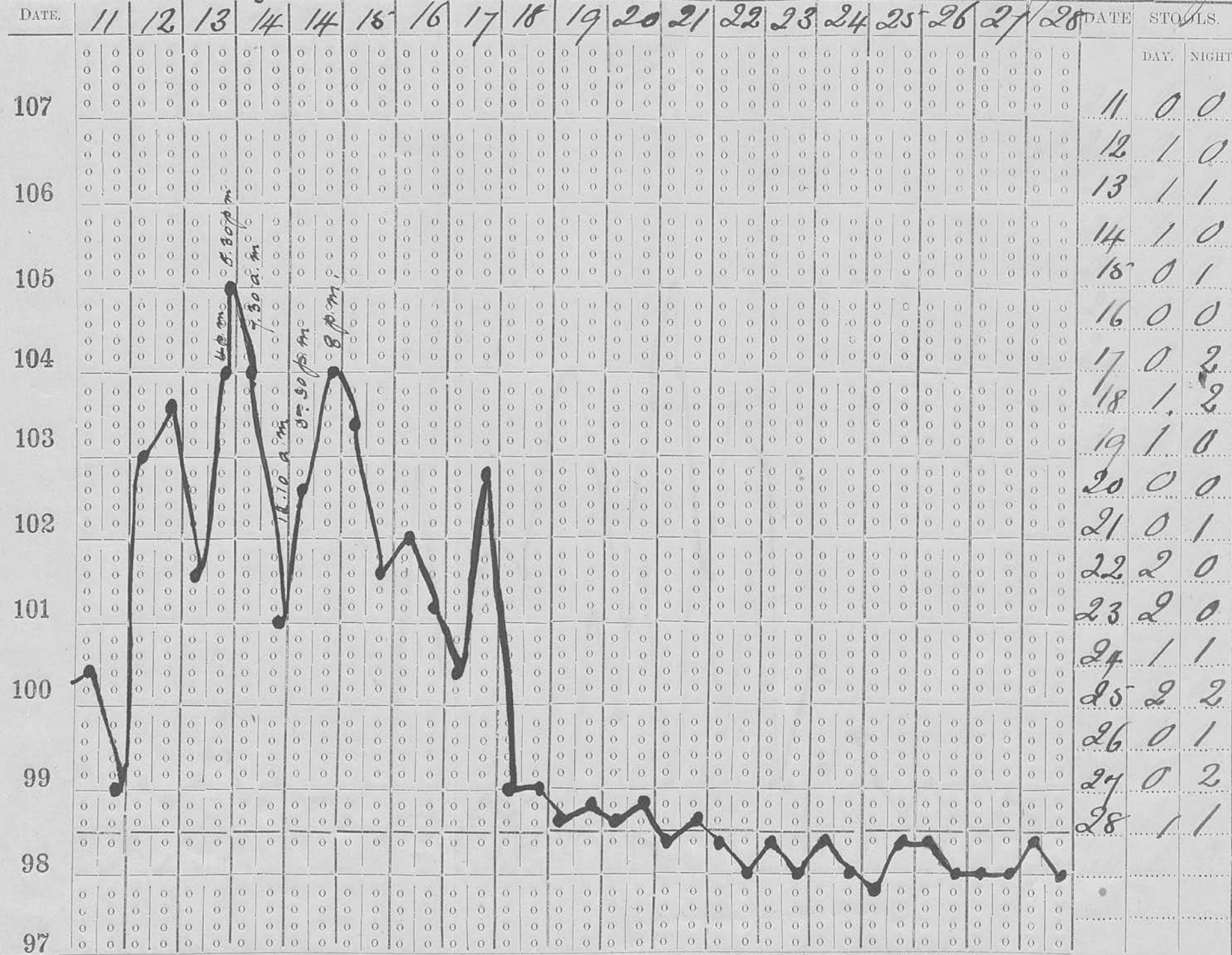
Most of the cases had little or no temperature on admission, only twelve of the series having a higher temperature than  $100^{\circ}$  F. In a few of the fatal cases, (nos 1, 2, 7, 8, 11, 17, 19, 23, 31) the temperature never rose above that point. In the majority, however, there was a rise of temperature a few hours, or a day or two, before death. The highest recorded temperature was in case 18, viz 106.6.

What conditions bring about this rise of temperature it is difficult to say. It does not depend, it would seem, on the severity of the attack. In no 17, the second worst case in the series, where the spasms were frequent and rigidity extreme, the highest record was  $100^{\circ}\text{F}$ , whereas in no 6, which at first sight appeared a favourable case, the temperature came up on the day of death to  $105^{\circ}\text{F}$ .

In like manner it does not seem to depend on the nature of the wound, the duration of illness before being subjected to treatment, the length of time treatment is carried on, or the nature of the treatment, as may be seen by comparing cases 2 & 21; both were mild cases on admission, both were of definite traumatic origin, both came under treatment in 24 hours - in both the treatment was identical, in the case of the first for two days longer than in the case of the second, and yet in the first the temperature never went beyond  $99$ , while in the second it reached  $103.4$  on the day of death. Whatever be the

WARD..... TEMPERATURE CHART, GENERAL HOSPITAL, BARBADOS.

NAME *Ada Goddard* DISEASE..... MONTH *January*



conditions, however, which govern the temperature a study of the temperature charts of the above cases brings us to this conclusion, viz., that while a low running temperature leaves room for hope, a high running temperature or a sudden rise of temperature is always, one may say, of nil augury. Case 40 is so rare an exception to this generalization that I give the history in full.

A. G. art 6, was brought to hospital December 23<sup>rd</sup> 1901, suffering from Tetanus. The jaws were separable for about  $\frac{1}{2}$  inch; the abdomen was rigid. Spasms were few, about 5 or 6 in the 24 hours. There was slight opisthotonus. Potassium Bromide gr x with Symp of Chloral Hy xx was given every four hours. By December 30<sup>th</sup>, the spasms were reduced to one or two in the 24 hours. On this date Santonin gr ii was given, and repeated on the two following days. This brought away 13 round worms. On Jan 1<sup>st</sup>, the evening temperature was 101. The note made that evening was: "jaws + abdomen rigid - spasms nil opisthotonus perceptible". Jan 2<sup>nd</sup> temp: 101<sup>6</sup>

Jan 3<sup>rd</sup>, 101.8; 4<sup>th</sup>, 101<sup>4</sup>; 5<sup>th</sup>, 100; 6<sup>th</sup>, 99.6.

As this was the 15<sup>th</sup> day, and as spasms had not returned, the dose of the Bromide and Chloral was halved, gr  $\bar{v}$  of the Bromide and  $\text{m} \bar{x}$  of the Symp of chloral being given every four hours. On the 10<sup>th</sup> Jan, this was given twice a day. "Spasms nil, opisthotonos very slight; jaws separable one inch. Abdomen still rigid as on admission.

On the morning of the 11<sup>th</sup>, the temp: was 100.4. The dose was again increased to gr  $\bar{x}$  of the Bromide and  $\text{m} \bar{xx}$  Syr: Chloral every four hours. Sulphate of Quinin gr  $\text{ii} \bar{ss}$  every four hours was also given.

On the evening of the 12<sup>th</sup>, the temp: was 103.6.  
one spasm at night.

Jan 13., temp: at 5.30 pm was 105. several spasms: opisthotonos moderate: face and lips swelled: lids puffy: delirious: no albumen in the urine.

Jan 14., morning temp: 104. Quinin gr  $\bar{v}$ .

At midday temp: was 101.; 5 pm 102.8;

8 p.m. 104. "considerable improvement:

two spasms. no delirium. face more swelled and erythematous. Quinin gr  $\bar{v}$  repeated.

Jan 15. evening temp 101.8. "No spasms -  
Opisthotonos slight. Lips cracked: skin of face  
beginning to peel"

Jan 16. dose again reduced to grv Bromide  
and  $\text{M} \times$  Symp of Chloral twice daily -  
the temp: continued to fall, and the  
general condition improved.

On the 17<sup>th</sup> there was a rise to 102<sup>8</sup>, but  
on the 18<sup>th</sup> a fall to nearly normal. From  
this date she made steady progress towards  
recovery, and all medicine was stopped.

Desquamation was complete on Jan 30<sup>th</sup>  
and she was discharged, cured, on Feb 8<sup>th</sup> 1902.

The erythematous rash was probably  
an indication that enough of Chloral had  
been given; accordingly the amount was  
reduced as rapidly as possible, and finally  
withheld on the 18<sup>th</sup>

### Treatment

Local. All wounds are freely laid open,  
and cauterized with pure carbolic acid.  
Carbolic poultices are then applied, and  
renewed every four hours.

Clippers are picked from between the toes,  
and Iodine tincture freely painted on.

In children, Santonin is administered as a routine practice, in deference to local experience. Although worms were present in Case 40 only, it is possible that these may be a source of infection sometimes.

General. Reliance is chiefly placed on Bromide of Potassium and Chloral Hydrate, or the Syrup of Chloral. In the series of 41 Cases it will be seen that 26 were put upon Bromide & Chloral.

8 " " Bromide, chloral & Opium,

1 " " Morphia & Bromide of Soda,

1 " " Morphia & Chloral,

1 " " Morphia,

1 " " Morphia & Chloroform,

2 " " Carbolic acid injection,

1 " " Carbolic acid and Opium.

When spasms are frequent and strong, Opium in some form, generally as a hypodermic of acetate of morphia, is given, with the view of keeping the spasms under control till the Bromide and Chloral have time to act. Enormous doses of the Bromide of Potassium & of Chloral Hydrate

have occasionally to be given before the spasms show any diminution of strength & frequency. As much as  $\frac{z}{iv}$  of Syrup of Chloral has been given by the rectum in case 19, and repeated every three hours, and with no effect on the spasms.

Case 20 was given  $gr$  120 of Bromide of Soda every two hours without effect, when Morphine was substituted.

Three patients were treated by hypodermic injections of Carboic acid. A short account of the most favourable is given.

A. 7 age 16 brought to hospital on April 9<sup>th</sup> 1900, with rigid jaws and abdomen, spasms and opisthotonos

A 3% solution of Carboic acid was employed. April 9<sup>th</sup>  $m$  xxxv injected. The note made that evening was "not much difference, spasms frequent"

Ap. 10<sup>th</sup>  $m$  xl injected. "above report holds good"

Ap. 11<sup>th</sup>  $m$  lxxv injected. "slight improvement in appearance, but spasms continue, open mouth a little wider. temperature rose from 99.2 to 101."

April 12<sup>th</sup> 77 ccv injected. "Spasms still frequent, opens mouth wider. Abdominal muscles more pliant towards afternoon"

April 13<sup>th</sup> 77 100, Temp: 101.2

14 77 80, Temp: 103.4

15 77 120, Temp: 103.6.

16 77 80, Temp: 106

Note from 13<sup>th</sup> "Temperature continuing to rise, & patient getting weaker; the operation of giving hypodermic injections does not bring on spasms"

In all 615 77 were injected i.e. about  $18\frac{1}{2}$  gr. of the pure carbonic acid. At no time was there any sign of carbonic acid poisoning.

As only one recovery had been scored thus far in 9 cases, it was considered justifiable to give this method a further trial. The result was very unsatisfactory, and a return to the Bromide of Potassium and Chloral Hydrate was made.