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Tetanus caused by occupational accidents

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LUISTO M, SEPPÄLÄINEN A-M. Tetanus caused by occupational accidents. *Scand J Work Environ Health* 1992;18:323—6. The role of occupational accidents as a source of tetanus is poorly known. In Finland, during the period 1969—1985, 28 (26%) of the 106 cases of tetanus were caused by occupational accidents, 16 of which occurred in agriculture and forestry. Twenty-one of the patients were men and seven were women. The mean annual incidence of tetanus was 1 per 100 000 occupational accidents during the study period. The cases were concentrated in summer and autumn. Most of the primary injuries were minor, 61% of the injuries occurring in the hands and fingers. Forty-three percent of the patients had not been immunized against tetanus, and 46% were unaware of their state of immunization. The systematic immunization of the population against tetanus is important because the disease is often caused by slight injuries not requiring treatment by health care personnel. This need is emphasized for work in agriculture, forestry, and other branches in which contact with soil or animals occurs.

Key terms: agriculture, forestry, immunization, injury.

Tetanus has been a complication of severe traumas and war injuries (1). In developing countries it is a common result of poor hygiene in the treatment of wounds and childbirth (2). In countries with a high standard of medical care, most of the population is effectively immunized against tetanus. Its incidence decreases, and the cases of tetanus are often caused by minor injuries (3). Although the epidemiology of tetanus in developed countries has been thoroughly examined (4—11), very little is known of tetanus as a complication of occupational accidents. Because of the occurrence of tetanus spores in the environment, the farming population has been suspected to be especially at risk of tetanus.

In Finland, 106 patients contracted tetanus during the period 1969—1985. The cases of tetanus caused by occupational accidents in that series are presented in this paper.

Subjects and methods

The Finnish National Board of Health has regularly kept a register of all hospital-treated patients from 1967 on. In Finland all patients with tetanus are treated in hospitals. Records on the patients treated for tetanus during 1969—1985 were collected from the register and analyzed. Altogether 106 cases of tetanus were found (mean 6.2 cases/year). There were 63 men and 43 women, and their ages ranged from 5 to 92 (mean 49.7, SD 18.0) years; 12 patients (11.3%) died (11).

For 100 patients a primary lesion leading to tetanus was identified. The records of these patients were analyzed regarding occupational accidents compensated by an insurance company. Those of patients with occupational accidents were analyzed for the occupation of the patient, the course of events concerning the occupational accident, immunization status, sick leave, type and grade of the disease, and the outcome of the disease.

The severity of the disease was classified into the following three grades: (i) mild disease without generalized muscular convulsions, (ii) moderate disease with generalized muscular convulsions, but without respirator treatment, and (iii) severe disease with generalized muscular convulsions requiring respirator treatment.

The data concerning the occupational accidents in Finland were obtained from the statistics of the National Board of Labour Protection. During the study period, the annual number of occupational accidents ranged from 102 520 in 1978 to 146 523 in 1972, and that of accidents on the way to or from work ranged from 13 300 in 1978 to 19 184 in 1971.

The preventive measures used for tetanus in Finland are the following: The primary vaccination includes three doses. The first two are given in infancy with an interval of four to six weeks, and the third is given after 6 to 12 months. Boosters are given at school to both sexes at the age of seven years, and to men at the age of 19 years during their military service.

Results

Tetanus was caused by an accident at work in 28 (26%) out of the 106 cases of tetanus during the period 1969—1985. Twenty-one of the patients were men, and

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Table 1. Occupational accidents causing tetanus in Finland in 1969—1985.

Patient	Gender	Age (years)	Occupation	Description of the occupational accident
Farming and forestry				
1	Male	43	Farmer	Splinter under the thumbnail while threshing barley
2	Female	49	Farmer's wife	Splinter under a fingernail
3	Male	47	Farmer	Splinter in the palm while cutting timber with a circular saw
4	Male	58	Farmer	Splinter in the hand in forest work
5	Male	59	Farmer	Splinter in the finger from firewood
6	Female	47	Farmer's wife	Twig stuck the big toe through a dirty shoe
7	Female	53	Farmer's wife	Cow trampled on the patient's toe
8	Male	29	Fox-farm worker	Fox bit the patient
9	Female	46	Poultry worker	Patient was cleaning the ventilator of the henhouse, and a hard object flew and hit her on the nose and cheek
10	Male	59	Farmer	Wound to a finger from a potato harvesting machine
11	Male	57	Farm worker	Two fingers crushed by a potato harvesting machine
12	Male	55	Farmer	Two fingers compressed by a piece of timber
13	Male	42	Farmer	Finger was compressed between a tractor and on iron bar
14	Male	54	Farmer	Hand stuck by the belt of a grain drier, the little finger was traumatically amputated and the thumb was crushed
15	Male	47	Forest worker	Patient fell and hit his nose on a stump of a tree
16	Female	49	Farmer's wife	Scratch on the leg from a stone in the forest
Driving				
17	Male	31	Driver	Wound in the popliteal fossa from a piece of sheet metal
18	Male	27	Driver	Shaft of a cart fell on the toe of the patient
19	Male	37	Driver of a backhoe	Back hoe had sunk in a swamp, it was being lifted when a muddy metal plate fell from the engine and cut a small piece from the tip of the patient's finger
Construction				
20	Male	46	Carpenter	Finger crushed by a compressed air cylinder
21	Male	58	Carpenter	Wound in the thumb from a circular saw
Accident on the way to or from the workplace				
22	Male	57	Mason	Neighbor's dog bit the patient's leg as the patient went to work
23	Female	62	Cook	Bicycle accident, on the way to work
Others				
24	Female	53	Brushmaker	Wound to the finger from a prick of a brush
25	Male	20	Engineer	Subungual hematoma
26	Male	31	Technician	Wound to the finger by an exhaust pipe of a car
27	Male	61	Storehouse worker	Patient stepped on a nail
28	Male	38	Unknown	Hand injured in a gravel screen

seven were women. The incidence decreased during the study period. The mean annual incidence of tetanus was 1 per 100 000 occupational accidents during the study period. The ages of the patients ranged from 20 to 62 years, the median being 48 (mean 47.0, SD 11.2) years.

Sixteen (57%) of the patients were employed in agriculture or forestry. Two accidents on the way to or from work were included because they were compensated as occupational accidents. The most serious injuries were crushed or traumatically amputated fingers; there were no life-threatening injuries. Fingers compressed or crushed by a soiled machine or tool were common sources of tetanus; a potato harvesting machine was involved in two cases. The three cases involving drivers occurred when the vehicle needed repair or lifting and there was contact with the soil. In six cases the primary wound contained foreign material (a splinter). In four cases the injury was caused by an animal bite, or there was contact with animal stools (cow, fox, dog, hen) (table 1). Puncture wounds, minor injuries, and excoriations were the most common primary injuries (table 2). The parts of the body most frequently affected were hands and fingers (17 cases, 61%). There was a clear seasonal difference, summer and autumn dominating (figure 1).

Most of the patients had never been immunized against tetanus or were unaware of their state of immunization (table 3). The graded severity of tetanus was milder in the group of 28 patients with an occupa-

Table 2. Types of primary injuries causing tetanus among 28 patients with an occupational accident.

Type of injury	Patients	
	N	%
Puncture wound	7	25
Minor injury[a]	7	25
Excoriation	6	21
Animal bite	2	7
Cut wound	3	11
Open fracture	2	7
Other	1	4
Total	28	100

[a] Minor injury = injuries that did not need treatment by health care personnel.

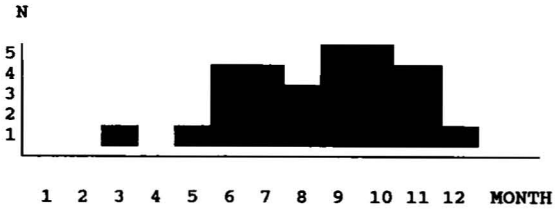

Figure 1. Tetanus caused by occupational accidents according to month of occurrence.

tional accident (eg, none of them died during the primary treatment period), although the difference in severity degrees did not reach statistical significance ($chi^2 = 3.04$, $P < 0.0812$) when these patients were compared with other patients with tetanus (table 4).

None of the 28 patients with tetanus caused by an occupational accident died during the acute stage of the disease, while the fatality rate among the other 78 patients was 12, seven of whom were already retired because of old age. In other respects there was no significant difference between the patient groups in the outcome of the disease (table 5).

Of the patients with tetanus caused by an occupational accident, two were institutionalized because of sequels of the disease, one because of bilateral peroneal palsies and the other because of serious anoxic brain damage. The latter died four years later. Twelve of the 23 patients who returned to work had sequels of the disease. Those sequels most often mentioned in the records of the patients were muscular fatigue or weakness (4 cases), amputation of a toe or a finger (4 cases), arthralgia (3 cases), and muscular stiffness (3 cases). Of the patients who returned to work, the sick leave was distributed as follows: <1 month for three (13%), 1—3 months for 13 (57%), >3 months for six (26%), and unknown for one (4%).

Table 3. Preventive measures taken for tetanus before the primary injury.

Immunization before the injury	Patients	
	N	%
Complete primary immunization	1	4
Complete primary immunization more than 10 years earlier	1	4
Incomplete immunization	1	4
No immunization	12	43
Uncertain	13	46
Total	28	100

Table 4. Severity of tetanus among the 28 patients who had an occupational accident (A) and among the other patients (B).

Group	Grade I[a]		Grade II[b]		Grade III[c]		Total	
	N	%	N	%	N	%	N	%
A	12	43	7	25	9	32	28	100
B	26	33	12	15	40	56	78	100

[a] Mild disease without generalized muscular convulsions.
[b] Moderate disease with generalized muscular convulsions, but without respirator treatment.
[c] Severe disease with generalized muscular convulsions requiring respirator treatment.

Discussion

Occupational accidents are an important source of tetanus, including a quarter of the cases in this study. On the other hand, tetanus is a rare complication of occupational accidents. There was only one case per 100 000 occupational accidents. The actual incidence may be even lower because many minor occupational injuries not leading to tetanus are not treated by health care personnel and thus are not always reported in the statistics.

The serious forms of tetanus (grades II and III) require long hospital treatment and even respirator and intensive care (12). They also cause long sick leaves and early retirement with considerable economic loss.

Table 5. Outcome of tetanus among the 28 patients who had an occupational accident and among the 78 other patients.

Outcome	Patients with an occupational accident		Other patients	
	N	%	N	%
Returned to work	22	79	55	71
Took lighter work	1	4	—	0
Retired	3	11	7	9
Institutionalized	2	7	3	4
Died	—[a]	0	12[a]	15
Unknown	—	0	1	1
Total	28	100	78	100

[a] Chi-square = 4.86, $P < 0.0275$.

Although no fatalities occurred among the patients with tetanus caused by occupational accidents in this series, tetanus still carries a considerable mortality rate (11) and causes sequels through various mechanisms. In a controlled study of 40 patients who had had tetanus, the patients had significantly more muscular fatigue and cramps, nervousness, decreased mental capacity, and difficulties in balance, speech and memory. They also had significantly more clinical abnormalities such as peripheral palsies, muscular atrophy, decreased or absent tendon reflexes, and decreased mental capacity than the referents (13).

In this series the disease was milder, although not statistically significantly so, in the cases associated with occupational accidents than in the other cases. It can be postulated that some of the workers had at least partial immunization against tetanus although they were unaware of it. Partial immunity ameliorates the clinical picture of the disease (14). Old age increased the risk of death and helped explain the higher fatality among the patients with no occupational accident.

As could be expected, most of the accidents leading to tetanus occurred in tasks with contact with soil or animals. Even a small splinter could be dangerous. In this series, the primary injuries caused by occupational accidents were neither life-threatening nor very serious. This is a common feature of the cases of tetanus in developed countries. In serious injuries needing hospital treatment also the prevention of tetanus is usually considered. Minor injuries which do not need treatment by health care personnel are an important source of tetanus.

Tetanus can only be prevented by systematic immunization of the population. It is especially important concerning workers in agriculture and forestry, including farmer's wives, and all tasks in which contact with soil or animals occurs. Routine immunization of the whole population against tetanus on every 10th birthday has been recommended (15). Especially, workers at risk of tetanus should be immunized.

Acknowledgments

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