

ON THE PATHOLOGY OF TRENCH FROST-BITE.

The *Lancet* of last week contains a most interesting article on the above subject, compiled by Dr. J. Lorrain Smith, F.R.S., Dr. James Ritchie, and Dr. James Dawson, of Edinburgh, who have investigated the subject at the request of the Medical Research Committee (National Health Insurance).

During the winter of 1914-15 a large number of soldiers fighting in the trenches in Flanders became disabled from the effects of cold in their feet. The condition is to be distinguished from true frostbite, in which very severe cold causes necrosis of the tissues. In cases of trench frostbite necrosis may occur, but it is not frequent, and the characteristic symptoms are swelling, pain, and disturbance of sensation in the feet. The inquiry consists of two parts: (1) the observation of the clinical condition of a number of cases which were under treatment in the military hospitals in Edinburgh; and (2) a study of the effect on rabbits' feet of conditions similar to those to which the soldiers were subjected.

From experimental observations, the investigators state that the microscopic examination of the tissues of the rabbit's foot after exposing it to the conditions and temperature from which soldiers suffered in the trenches in winter, showed that the chief effect of the cold was on the blood vessels. The report states:—"We have no opportunity of examining tissues from the human subject after trench frostbite, but there is no reason to doubt that the changes in the animal tissues are the same as those in man. The effect is inflammatory, and is due to the direct action of the cold on the tissue. The injury to the blood vessels is the most important element. The walls are so damaged that they are unable to perform their function; an excessive amount of fluid is poured out and accumulated in the tissue. From this fibrin is deposited, and the fibrous elements of the tissue are disintegrated more or less. When there is any congestion of the damaged vessels, as may be caused by the application of warmth, the walls rupture and blood corpuscles are poured into the tissue. Recovery from such a condition is naturally slow. Not only has the swelling to subside, but the damaged vessel wall has to be repaired so that it can bear the strain of normal circulation.

"We carried out a few observations on the effect of actually freezing the tissues by the application of carbonic acid snow. Our observations show that the slighter stages of injury

in true frost-bite are essentially similar to trench frostbite. In true frostbite the predominant change is death of the affected part; in trench frostbite there is little or no necrosis, but an exudative inflammation occurs in the parts directly exposed to the cold. . . ."

Finally, the harmful effect of raising the temperature of the feet damaged by cold was clearly demonstrated.

Practical Considerations for Prevention.

The following practical considerations are suggested by the foregoing investigation. The main efforts must be directed towards prevention. As the condition is one of damage to tissues, once it has been established recovery can only take place after a prolonged process of regeneration.

1. The soldiers should practise massage on their feet before going to the trenches. There is some evidence to show that persistent rubbing of the feet beforehand has enabled the men to escape to a considerable extent the effects of exposure to cold.

2. A study of the cases shows that the symptoms begin to be felt, as a rule, after 48 hours' exposure. It is clear, therefore, that to shorten the time in the trenches would be the most essential measure of prevention.

3. While men who have been exposed to the conditions causing frostbite without having been affected are resting between their turns of trench duty, they should persistently practise massage of their feet twice daily.

4. Careful attention should be given to anything which may constrict the blood vessels. Constriction by boots and puttees should be avoided. Loose moleskin leggings would probably be found more suitable than puttees, as they would provide warmth without constriction. The advantage of leggings is that they provide the protection of an ample cushion of air, and they drain more readily than compact wrappings, the existence of a non-conducting air cushion being thus re-established. The soldiers wear boots of a large size, but they have a practice of putting on two pairs of socks, and this probably tends to a certain amount of constriction. It was observed that the excoriations were situated on the outer and inner borders of the feet, and this fact suggests that some degree of constriction existed. It is significant that the parts most liable to trench frostbite are the parts where under ordinary circumstances callosities and corns are most frequent. The question arises whether the upper leather of the boots could be made more pliable without diminishing the stability of the sole or of the boot generally. The soldiers very

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