A STUDY OF FOUR HUNDRED AND FIFTEEN CASES OF TETANUS.

BY DAVID W. YANDELL, M.D.,

Professor of Surgery in the University of Louisville, Kentucky, &c.

SOME years back I collected from such medical journals, domestic and foreign, as were within my reach reports of three hundred and eighty-five cases of tetanus. To these were added thirty unpublished cases gathered from practitioners in this city, making a total of four hundred and fifteen cases. The work of tabulating and examining these was kindly done by my friend and colleague Prof. Cowling. The results obtained I propose to summarise here.

Of the total, two hundred and thirty-three cases recovered, one hundred and eighty-two died. It is apparent that for purposes of comparison such results are clearly worthless; but they serve to show that statistics on this point are as imperfect now as when Mr. Curling published his tables in 1837. This obviously arises, I think, from the practice of reporting recoveries only, deaths not being considered a matter of interest. In confirmation of this opinion, I have to state that of the thirty cases now published for the first time, 90 per cent. died. In the three recoveries, one went without treatment, except systematic nourishment; the second was brought through by a "Thompsonian" with steam and lobelia; while the third, having for its only symptom but a slight trismus, which disappeared after a little hypodermic atropia, cannot fairly be regarded as tetanus. Further, the character of the practitioners who treated these cases is an ample guarantee that everything was done which patience and skill

could suggest, the frightful mortality belonging simply to the history of the affection.

But though the tables before me are worthless as to aggregate deaths and recoveries, and are perhaps of no real value as denoting the comparative efficacy of different remedies, yet I think that in the lessons they teach it will be found that in more than one important particular, at least, they serve to throw light on tetanus, the date of its invasion and the duration of the tetanic symptoms, and the influence of these on the general result.

Sex.—This is stated in but 375 cases, 80 per cent. of these were males. The greater exposure of men to the exciting causes of tetanus is usually regarded as sufficient to explain this disparity, yet in 34 cases of idiopathic tetanus 70 per cent. were males. Of males, 44 per cent. recovered; of females, 58 per cent., or, excluding puerperal tetanus, 63 per cent. recovered. It will be observed that these results quite approximate those furnished by Mr. Curling, while they differ from those stated by Mr. Poland,¹ who finds a much greater preponderance of cases in males and of deaths in females.

Age.—The first decade of life furnished 7 per cent. of all the cases. Of these, 62 per cent. died. If prognosis in tetanus be influenced by age, it is less favourable at this period than between ten and twenty years, where the cases rose to 20 per cent., while the mortality fell to 38 per cent. The death-rate could not be made out in the remaining decades, owing to the large number of cases which were reported simply as adults. Fifteen cases are recorded as occurring in individuals over fifty years; and one case in a man aged eighty-nine is reported.

If this very striking difference in the death-rate of so large a number of cases is not a mere coincidence, it would seem very clearly to indicate that while tetanus is comparatively rare, it is also peculiarly fatal in persons under ten years of age; and if to this list the cases of trismus nascentium ending fatally be added, the percentage of deaths would be enormously augmented.

¹ Holmes's 'System of Surgery.'

The tables furnish nothing new as to the character of the wounds which are succeeded by tetanus. Wounds of the extremities and punctured wounds still cut the largest figure in this class of injuries. The popular belief that injuries of the foot are more liable than those of other parts to be followed by tetanus is quite confirmed as to punctured wounds in this situation—the large majority being inflicted by nails run into the foot. Yet the cases as a whole give but eighty-eight wounds of the foot against ninety injuries of the hand. There were twenty-eight instances of wounds of the upper extremities, exclusive of the hand, and sixty-seven in the lower extremities, exclusive of the foot. Wounds about the head are credited with twenty-eight cases; injuries of the trunk with four, chancre with one, abrasion of the cornea with one, while ten followed abortion. Neither the situation nor character of the injury seemed to exercise any influence on the prognosis of the disease. Forty per cent. of deaths followed wounds of the hand and 44 per cent. wounds of the foot. The death-rate in puerperal tetanus reached 90 per cent.

Date of Invasion.—A much more important point than either of the foregoing is the time at which tetanic symptoms appear. The disease supervened within two weeks after the injury in one hundred and ninety-six cases. Of these, 62·5 per cent. died. From the fourteenth to the twenty-first day, 17 per cent. of eighty-one cases were fatal. From the twenty-first till the forty-fourth day there were seventeen cases, of which 17 per cent. died. In cases occurring within seventy-two hours after injury, recoveries exceeded deaths as 14 to 11. In such as occurred between the fourth and the ninth day, deaths exceeded recoveries as 73 to 33—69 per cent. In cases beginning on the thirteenth day, deaths stood to recoveries as 7 to 3; but where tetanic symptoms were delayed till the fourteenth day, recoveries were notably in excess of deaths—23 per cent.

It is a source of regret that in more than one-fourth of all the cases the date of invasion is not given; but it has been recorded in a sufficient number, I think, to show both the difference between acute and chronic tetanus—the difference between the percentages themselves—and finally, how these

differ from the standard of 46 per cent. of total deaths. It is true that the date of invasion is not the only element of dissimilarity between acute and chronic tetanus. But it is an important one; the degree of tetanic symptoms, the muscles involved, pulse, temperature, &c., are others which should not be lost sight of, but which these tables fail to show with a fulness sufficient to warrant even an approximative conclusion.

Duration of Symptoms.—The tables confirm in the main the well-known aphorism of Hippocrates, that tetanus, when fatal, is nearly always so within the first four days after attack. Sir Thomas Watson suggested that the period be extended to nine days. The first notable diminution in death ratio, as shown in the tables, occurred in those cases which had survived fourteen days. From that period the recoveries were progressively in excess of deaths. To illustrate: in tetanus continuing four days, eighteen cases give 50 per cent. of deaths; continuing nine days, there were one hundred and thirty-one deaths to thirty-nine recoveries, while in one hundred and five cases continuing from the ninth to the twenty-third day, there were eighty-two recoveries to twenty-three deaths. In seventy-four cases which survived beyond the twenty-third day but three died, death occurring in each on the twenty-eighth day. The largest number of deaths, thirty-one, fell on the second day. On the fourth day there were twenty-one deaths. There is a marked falling off in deaths on the fifth day, when there were but eleven deaths; from this time the percentage of deaths steadily diminished. The longest duration of symptoms is two hundred and forty days; the shortest, ending in recovery, is alluded to in the beginning of this article; the shortest in death, is in a few minutes. Nine cases lasted forty-two days; eighteen cases lasted thirty days. Between these two periods we find nineteen cases. Sixty and ninety days are also represented.

The Pulse and Temperature.

These have been recorded in too small a number of instances to admit of any deductions.

Dr. Radcliffe (Reynolds's 'System of Medicine') has stated

that there is an absence of fever in tetanus, and explains the heat and frequency of pulse, when they occur, by the dyspnœa, which urges the skin to take on compensative action. In three cases in which the temperature was recorded, and published now for the first time, the mercury rose to 106°–107°. They were all fatal. In two other cases, also fatal, observed by the writer, the pulse was one hundred and twenty from the beginning of the attack.

Treatment.

This is a matter which has been so varied and so complicated in different cases as to set at defiance all efforts at anything approaching accurate tabulation. The bare enumeration of the remedies used would more than fill one of these pages. Selecting the fifty leading agents to which recoveries are credited, it will be found that in a very small number of cases indeed has the treatment been trusted to a single agent alone. In the large majority of instances very varied combinations of the most powerful along with the least active agents in the Pharmacopœia were made, whereby it was rendered quite impossible to decide what part was played by either in the cure. In the following case, for instance, which I may add is but a type of many such found in the tables, the cure is credited to the subcarbonate of iron:—V. S. 3 xvj.; electuary of subcarb. iron and turpentine; emp. vesic. over epigastrium, enemas of turpentine, friction with camphor liniment, tonics. Certainly no one can believe that either of the agents mentioned exerted the slightest influence over the course of the disease.

In order to determine as far as possible the relative value of the various plans of treatment practised, everything which seemed to possess any real power has been carefully noted; also the percentage of recoveries under each; the number of recoveries occurring in cases where tetanus followed within nine days after the injury, the number of recoveries where the disease continued less than fourteen days; and finally the mortality in cases where the date of invasion was over nine days after injury, and where the disease continued beyond fourteen days.

The importance of viewing the management of tetanus from this standpoint will be found in the fact that a careful study of these tables goes, I think, to show that the *results* of treatment by the different remedies are so nearly the same *that no one agent can justly be said to possess a decided superiority over any other.*

The mere number of hours or days which intervene between an injury and a subsequent attack of tetanus, is, I am aware, but one of the characteristics which distinguish acute from chronic tetanus; but it is, perhaps, the very heaviest factor in any attempt to estimate the effect of treatment and the comparative value of the remedies used. I think that without it no correct opinion can be formed as to the part which any individual agent, or which treatment, as a whole, plays in the management of the disease.

In order to economise space rather than because it adequately portrays the several features whereby acute is known from chronic tetanus, I shall in what follows designate that form of disease which supervenes within nine days after the injury as acute, and that which occurs subsequently as chronic tetanus.

Aconita.—Fourteen cases; all chronic; 8 per cent. recovered; none recovered before fourteen days.

Amputation.—60 per cent. of seventeen cases recovered; four acute; four in less than fourteen days. Three chronic cases died, and one after fourteen days.

Bleeding.—55 per cent. of fifty-eight cases recovered: nine acute, ten before the fourteenth day. Seven chronic cases died, and two after fourteen days.

Calabar Bean.—39 per cent. of recoveries in thirty-nine cases. One recovery only occurred in the acute form of the disease. In five others recovery took place before the expiration of fourteen days. *Per contra* ten cases of chronic tetanus proved fatal.

Ohloroform relieved 70 per cent. of thirty-five cases, nine of which were acute, and eight recovered before fourteen days. Three chronic cases died, and two after symptoms lasted fourteen days.

Cold Effusion.—73 per cent. of eleven cases recovered; three acute; three before fourteen days. Two chronic cases died.

Division of nerve relieved 75 per cent. of three cases: one acute; one before the fourteenth day. One chronic case died.

Ether.—6 per cent. of fifteen cases recovered: five acute; seven inside of fourteen days. One chronic case died.

Indian Hemp.—Used in twenty-five cases, with 64 per cent. of recoveries, of which three cases were acute, and six recovered before the symptoms lasted fourteen days. One chronic case died, and one after fourteen days.

Ice-Bags.—77 per cent. of nine cases recovered: one acute; two in less than fourteen days.

Mercury.—57 per cent. of seventy-five cases got well: eight acute; twelve before fourteen days. Seventeen chronic cases were lost, and two after fourteen days.

Opium.—57 per cent. of 165 cases recovered: twenty-two acute; twenty-nine before fourteen days. Twenty-six chronic cases were lost, and four after the disease had continued fourteen days.

Purgatives.—66 per cent. of seventy-four cases recovered: thirteen acute; twelve before fourteen days. Ten chronic cases died, and three after fourteen days.

Quinine.—73 per cent. of fifteen cases recovered: one acute; three before fourteen days. Three chronic cases ended fatally, and one after fourteen days' duration.

Stimulants.—8 per cent. of thirty-three cases recovered: four acute; six within fourteen days. Six chronic cases died, and three after fourteen days.

Tobacco relieved 50 per cent. of forty-one cases; six acute; six before fourteen days of the disease. Four chronic cases died, and one after fourteen days.

Turpentine relieved 70 per cent. of sixteen cases: six acute; four before fourteen days. Five chronic cases died, and two after fourteen days.

I think these facts certainly show, as far as they go, that we are not improving in our treatment of tetanus. Chloroform ranks in these tables as the most efficient agent yet known in acute tetanus; while even mercury and venesection, which belong to a past age, excel the Calabar bean, of which so much

was expected, not only in general results, but in power of control over the disease in its acute form. An astonishing fact is that in the long list of remedies there are but three—musk, woorari, and warm baths—where the percentage of recoveries was less than by the Calabar bean; and even here the first and last of this trio effected an equal number of cures of acute tetanus. It is but just to the friends of the bean to say that these tables were prepared when the effects and doses of this drug were not so well understood as at present; yet in nine cases of tetanus seen by the writer since that time, and all treated by the bean and chloral hydrate, the percentages remain quite the same. The conclusions which a careful review of the tables would seem to warrant may be summarised as follows:—

I. That traumatic tetanus is most fatal during the first decade of life.

II. That it usually supervenes between four and nine days after the injury.

III. That the largest number of recoveries are found in cases in which the disease occurred after the lapse of nine days from the injury.

IV. When tetanus continues fourteen days, recovery is the rule and death the exception, *apparently independent of the treatment.*

V. Tetanus arising during the puerperal state is the most fatal form of the disease.

VI. Chloroform has up to this time yielded the largest percentage of cures in acute tetanus.

VII. The true test of a remedy for tetanus is its influence on the history of the disease: (a) Does it cure cases in which the disease occurred prior to the ninth day after the injury? (b) Does it fail in cases whose duration exceeds fourteen days?

VIII. Tried by these tests, no agent has yet established its claims as a true remedy for tetanus.