TETANUS AND IPPR: A PARTIAL PARALYSIS REGIME

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This is an account of the management of a case of tetanus, firstly by conservative treatment and then by tracheostomy and IPP ventilation but falling short of the total paralysis regime.

CASE HISTORY

Six days before admission to the Respiratory Unit, Joyce Green Hospital, in October 1960, the patient, a youth of 18, fell whilst playing football and lacerated his knee on a flint. The same day the wound was cleaned and sutured at his local hospital, but no anti-tetanus serum was given. The evening before admission his jaw began to ache and by morning he felt ill and started to have trismus and painful muscular spasms, which became more frequent and severe.

On re-attending the hospital he was diagnosed as having tetanus and was given 3,000 units anti-tetanus serum intravenously. The prognosis at this stage was considered to be extremely poor, since the incubation period was only 5 days and generalized convulsions developed with in 24 hours.

On admission, the patient was a healthy youth of 18, weighing about 130 lb. (59 kg). There was a sutured wound over the right patella which appeared to be healing well. He had a slight pyrexia, tachycardia and tachypnoea.

The cardiovascular system was normal. Examination of the central nervous system revealed generalized hypertonicity of all major muscle groups with exaggerated reflexes. Mild stimuli produced marked tonic convulsions with opisthotonus and breath-holding. These lasted about 15 seconds but were not accompanied by cyanosis.

White cell count: 18,000 per cu.mm with 81 per cent polymorphs. Normal urea and electrolytes.

Management.

He was immediately taken to the operating theatre and under a general anaesthetic the wound was completely excised, left open and washed with hydrogen peroxide. At the same time a plastic nasogastric tube was passed for feeding purposes and an intravenous drip containing 100,000 units of anti-tetanus serum set up.

It was decided to attempt conservative treatment and he was given phenobarbitone 3 grains (180 mg) 8-hourly, pectazine (Pacatal) 100 mg 8-hourly, mephenesin 3 g 2-hourly, all by tube. Complan (a protein hydrolysate) was used for feeding, and penicillin 250 mg was given 8-hourly.

During the next 48 hours the incidence of spasms was markedly decreased and only three of any severity were seen, each being accompanied by cyanosis. However, salivation became troublesome and a small quantity was inhaled on one occasion, necessitating a head-down tilt, suction and vigorous physiotherapy. By this time the patient was unconscious from the synergistic effects of the sedatives and in between the spasms there was marked hypotonia of the trunk and limb muscles.

During the third major spasm there was marked cyanosis and the patient was immediately intubated prior to tracheostomy. This was performed under local analgesia. A cuffed tracheostomy tube was inserted and ventilation was commenced using a Radcliffe Mark 2 IPP machine.

IPP regime

The sedatives and mephenesin were discontinued and 20 mg doses of the muscle relaxant laudexium methylsulphate (Laudolissin) were given intramuscularly with hyaluronidase. Laudexium was chosen since it is said to have only one-quarter to one-third of the ganglioplegic effect of d-tubocurarine chloride (Collier and Macauley, 1952), and is longer acting. The injections were given only when a muscular spasm was seen and no attempt was made to maintain complete paralysis.

Two further amounts of anti-tetanus serum, each of 100,000 units were given intravenously. For the next 18 days this regime was continued.

Posture.

The patient was turned from the full lateral position to the opposite lateral position every 2 hours and was never allowed to remain lying flat except during physiotherapy or for a change of tracheostomy tube. At first a slight head-down tilt was employed to assist drainage of secretions but this produced oedema of the eyelids and was discontinued; after which the patient was kept flat with a single firm pillow supporting the head.

Suction.

Tracheobronchial suction was performed every 30 minutes initially, using a soft rubber catheter with additional side-holes near the tip. As the quantity of secretions was not great, this was later performed hourly. Frequent oral toilet was carried out and pharyngeal suction used to clear the saliva which was occasionally copious.

Physiotherapy.

The chest received attention three times daily and on other occasions when it seemed necessary, always accompanied by suction through the tracheostome.
The limbs were put through a full range of passive movements and the chest compressed and percussed. As these manoeuvres initiated muscle spasms they were best performed after an injection of laudexium. Had sufficient staff been available, they would have been performed more frequently and it was noticed that following a night without physiotherapy the amount of secretion obtained in the morning was considerably increased.

Paralysis.
Although complete paralysis was not aimed at, laudexium is a long-acting agent and some degree of myoneural block may have been present for much of the time. There was no difficulty with IPP ventilation in the early stages when the injections were fairly frequent but later on when less frequent the patient had to be "coached" to breathe with the machine, which he did readily.

Tracheostomy.
The cuffed tube was changed several times during the treatment but never became crusted with secretions because the inspired air was humidified and suction was carried out frequently. Despite the fact that a non-touch technique was used for suction, the wound became infected with Ps. pyocanea. In our experience this is the most common organism in this situation and necessitated a change of antibiotic to eradicate it.

The pulse was monitored using a pulse indicator and there was a persistent tachycardia, up to 140 beats per minute throughout this period. There was also pyrexia, with spikes up to 103°F on several occasions. The blood pressure remained normal and frequent e.c.g. tracings demonstrated no abnormality beyond slight T-wave changes of doubtful significance. His chest was clinically and radiologically clear and only a moderate amount of sputum was aspirated from the tracheostome apart from the increase following physiotherapy.

As a guide to the ventilation frequent blood-gas estimations were made, using the arterial puncture technique and the Riley method of analysis described by Riley, Campbell and Shepard (1957). These are illustrated on a graph (fig. 1) and will be discussed.

It was noted that there was a gradual diminution in the requirement of laudexium from 12 mg per hour initially down to 2 mg per hour averaged over a 24-hour period (fig. 2). Soon after treatment commenced, the patient regained consciousness and was able to communicate with us, answering simple questions by movements of his face and one hand. When the requirements of laudexium had fallen to 2 mg per hour the drug was stopped on the eighteenth day and the patient was allowed to breathe spontaneously. There were no further spasms. Twenty-four hours later a silver speaking-tube was inserted and he started taking food by mouth. Some residual limb and jaw stiffness remained and it was several days before they wore off and he could open his jaw fully. After a further two weeks the tracheostomy tube was removed completely and the wound healed without incident.

![Blood gas analyses](image)
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On being questioned about his experiences, he said he could remember only isolated incidents and faces, but that he had recurring dreams. The most frequent dream was that he was at the cinema watching a film. When the performance ended the audience left but he could not move because his limbs were too stiff and he felt "rigid all over". At this point he felt an injection and "everything went black". There were no further sights or sounds until the next dream.

DISCUSSION

After suitable instruction the timing of each dose of laudexium was left to the discretion of the nursing staff, who rapidly came to ignore smaller muscle movements and gave each injection only at the beginning of a major spasm. The success of this arrangement appears to be borne out by the recurring dreams of stiffness relieved by an injection.

In this case the use of intermittent doses of a myoneural blocking agent worked well and total paralysis was unnecessary, the technique enabling the progress of the spasms to be judged.

With regard to the blood gases, it was possible to keep the Pco₂ within normal limits by altering the minute ventilatory volume according to the results of the arterial blood analyses. This was not so in the case of the Po₂, which showed considerable variations. This is thought to be due to changes in pulmonary perfusion, some areas of the lung being underventilated while other areas are overventilated. At the lowest point on the graph in figure 1, when the Po₂ fell to 60 mm Hg, the addition of oxygen to the inspired gases raised the value considerably. In other words, the Pco₂ could be controlled by altering the total ventilation, whereas a reduced Po₂ required an increase in the partial pressure of oxygen in the gas mixture. Finally, measurements of oxygen saturation, for example, by oximetry, appear to be unreliable as a guide to the state of oxygenation, except in so far as they indicate deviation from the normal, the extent of which can be determined by direct measurement of the arterial Po₂. It would seem desirable to add oxygen to the inspired gases routinely.

SUMMARY

A successfully managed case of severe tetanus is described. Initially treatment was conservative and this was followed by tracheostomy and IPP ventilation using a modified total paralysis regime in which laudexium with hyaluronidase was given by intramuscular injection. It was found possible to keep Pco₂, but not Po₂, within normal limits by ventilatory adjustment.

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REFERENCES
