ORIGINAL ARTICLE

Treatment of Severe Tetanus With Mechanical Ventilation in Developing Country

by

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Abstracts

Mortality of tetanus is high, particularly in severe cases managed without the aid of mechanical ventilation.

During 1980, six cases of severe tetanus were treated in the Pediatric ICU, Dr. Cipto Mangunkusumo General Hospital Jakarta, due to recurrent apnoeic attacks.

Sodium thiopental (Pentothal) were used as sedative agent for mechanical ventilation, and as muscle relaxant.

Three children survived and 3 died while on IPPV from extensive bronchopneumonia (2 cases) and septicemia due to pseudomonas infection. The other complication was vertebral fracture. None of the hemodynamic and respiratory variables was caused by sodium thiopental.

There were no direct complications of mechanical ventilation i.e. pneumothorax and pneumomediastinum.

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Introduction

Tetanus is still a major public health problem in most developing countries and still carries a considerable toll of morbidity and mortality (Tdujillo et al., 1980).

Diagnosis of tetanus can be established easily through clinical symptoms and signs even without examining serologic or other haematological study, but the fatality rate is still approaching 45% (Beaty, 1977). This high fatality rate may be partially related to the lack of specific therapeutic modalities and an orderly aggressive patient care plan (Trujillo et al., 1980).

As a developing country in Southeast Asia with the population of 147 millions, Indonesia has also a problem with the high incidence of tetanus besides gastroenteritis, tuberculosis and other tropical diseases. In the Dr. Cipto Mangunkusumo General Hospital Jakarta for instance, during 1979, 157 cases of tetanus were admitted in the ordinary ward with the mortality of 12.10%. The fatal cases are patients with severe convulsions, respiratory distress, apnoeic attacks and other severe complications i.e. hyperthermia. Actually these patients should be treated in pediatric ICU with non depolarizing neuromuscular blocking agents and mechanical ventilatory support.

However, due to the limited facilities, not all severe tetanus cases could be treated in the Pediatric Intensive Care Unit of the Dr. Cipto Mangunkusumo General Hospital.

The purpose of this paper is to present our experience in the management of cases of severe tetanus with diazepam (Valium), Sodium thiopental (pentothal) and mechanical ventilation.

Material and methods

We have carried out this investigation of severe tetanus cases treated in the Pediatric Intensive Care Unit of the Dr. Cipto Mangunkusumo General Hospital, Jakarta.

What we mean by severe tetanus is tetanus children with severe convulsions, severe respiratory distress, apnoeic attacks and other severe complications i.e. hyperthermia, laryngeal spasm which couldn't be managed in the ordinary ward. The management of tetanus patients in our Pediatric Intensive Care Unit are as follows :

1. Reestablishment and maintenance of airway :
   After the oropharynx has been cleaned, the patient is reoxygenated and properly ventilated, then intubated. Tracheostomy is always performed in the next 7 days.

2. The children are ventilated with the Bird Mark 8 pressure cycle ventilator, using assisted controlled respiration if the patient gets apnoea. Sterile tracheal care, strict asepsis, physical therapy and range of motion exercises are performed on all patients.

3. Sedative and anticonvulsant drugs. Muscle relaxation and sedation are

achieved by diazepam in doses of 5 - 10 mg/kg per day in continuous IV infusion and pentothal in doses of 2.5 - 5 mg/kg every convulsion. But if convulsion is frequent, pentothal is given by continuous IV infusion in doses of 2.5 - 5 mg/kg per hour.

4. Antibiotics, tetanus antitoxin.
   Antibiotic therapy is routinely used to help eliminate the tetanus infection. During the critical period of treatment, a broad coverage is used in accordance with the clinical condition until the result of tracheobronchial and other bacteriological cultures. All patients receive 20.000 units horse tetanus antitoxin per day within 2 days. No allergic reaction are detected. Toxoid tetanus is given before discharge.
5. Care of the site of infection.
   The site of infection is cleaned, debrided and drained.
6. Catheterization of central venous system,
   An intravenous catheter is introduced into the central venous system preferably through the basilic vein by cutdown, and used for monitoring CVP, supplemental hydration, intravenous medication. This catheter is left in place unless evidence of local or generalized infection is detected.
7. Feeding.
   During the first 72 hours the daily glucose-electrolyte and plasma are administered intravenously as the risk of aspiration from uncontrolled spasm is greatest during this period. Thereafter, nasogastric feeding is introduced and the amount gradually increased. In most cases nasogastric feeding is fully established by the 7th day and the IV drip being continued only for the administration of drugs,
8. Others.
   Due to our facilities we cannot monitor intracrainal pressure. So in case of suspected cerebral edema due to apneeic attack and severe convulsions we give glycerol 10 cc/kg per day with dexamethasone 1 mg/kg as initial dose and there after 0.2 mg/kg every 6 hours given for 5 - 7 days. Body temperature is decrease with hypothermic
9. Laboratory.
   Routine laboratory test, acid - base examination, electrolytes, cultures, and X rays are performed frequently for adequate evaluation.

Result

During 1980 six cases of severe tetanus were treated in the pediatric ICU Dr. Cipto Mangunkusumo General Hospital Jakarta, consisted of 3 boys and 3 girls. The yongest is 3 years and the oldest is 11 years. All patients were referred to the Pediatric ICU because these patients were impossible to be treated in the Pediatdic ward. Five cases were with recurrent apnoeic attacks and 1 case with respiratory distress. No one had an incubation period of more than 7

days and all patients had a period of onset of less than 48 hours.

Table 2 shows clinical and blood gas examination on admission in the Pediatric

decrease of consciousness (soporic), but only 1 case indicated a moderate consciousness (apathetic). Blood gas examination on admission revealed that 2 patients had slight increase of PaCO2. Five cases had respiratory distress, 3 cases with hyperthermia and 3 cases with severe convulsions on admission. Duration of using IPPV were 5 to 29 days. Three children survived the illness and 3 died while on IPPV from extensive bronchopneumonia (2 cases) and septicemia due to pseudomonas infection. Bronchopneumonia was the leading complication in our series, 2 cases by staphylococcus and 2 cases by H. Influenzae and Klebsiella.

The other complication was vertebral fracture in case no 3. None of the hemodynamic and respiratory variables was caused by sodium thiopental.

Discussion

Tetanus is a preventable disease which is still frequently seen in developing countries. Mortality is high particularly in severe cases managed without the aid of mechanical ventilation. Change of prognosis is expected with the use of supporting measure and the recent advances in knowledge and management of acute respiratory

well as material and equipment currently used in the ICU. In the Department tof Child Health Dr. Cipto Mangunkusumo Hospital Jakarta, tetanus constitutes the third major disease which was treated during 1979 with the mortality rate of 12.10%.

Usually the patients can be managed with phenobarbital, chlorpromazine and diazepam except in severe cases which must be treated in the ICU with sophisticated equipment

medical personnel.

In this series we used sodium thiopental (pentothal) as sedative agent for mechanically ventilated patients as Carlos et al., has done in 1978. We prefer pentothal as muscle relaxant because it is less expensive and available in our hospital.

Pentothal is a short acting barbiturate which has been used as induction and maintenance agent in anesthetics. After an intensive research with monkeys, since 1972 pentothal constituted one of the drugs of choice for resuscitation of brain ischemia (Safar et al., 1978).

Almost all our patients in this series are hospitalized in the Pediatric ICU due to recurrent apnoeic attacks which is difficult to be treated in the ordinary wards. The apnoeic attacks seemed to be caused by laryngospasm which may leave the patient hypoxic and exhausted (Alfery and Rauscher, 1978). One of the possibilities of other causes of apnoeic attack is intoxication in the brainstem as stated by Adams et al., (1966). But in our cases no other symptoms of brainstem intoxication such as hypothemia, flaccidity, severe sweating were seen.

The severity of our cases were also seen from the short incubation period and the "period of onset" (Table 1), and it was also seen from the clinical symptoms on admission (table 2). The decrease of consciousness in our 5 cases may be due to brain ischemia which was caused by recurrent apnoeic attack so that brain hypoxia occurred. We have carried out treatment to avoid brain damage with the method known as brain resuscitation by giving glycerol, dexamethasone and others as described by Safar (1978) and Hoff (1978). Although our cases showed recovery of consciousness, follow up of clinical, neurologic and electro encephalographic (EEG) examination are still needed. In recovered tetanus cases abnormalities are often found as reported by Illis and Taylor (1971). Bronchopneumonia was the leading complication in our series and 2 of our cases died due to staphylococcus, Klebsiella and Haemophilus Influenzae.

According to Alfery and Rauscher (1978) respiratory complications are frequent and occur early in the disease. A restrictive ventilatory defect result from rigidity of chest wall compliance, shallow breathing and decrease ability to cough, atelectasis and pneumonia with accompanying hypoxemia may follow.

Since the introduction of artificial ventilation in the treatment of tetanus, uncontrolled spasms as a cause of death disappeared, but other complications may be expected. Although some of them are attributable to the operation of the ventilator (disconnection, leaks, malfunction, etc.) many problems involve medical complications closely associated with mechanical ventilation (atelectasis, brochopneumonia, braintrauma, cardiac arrhythmias etc.). We didn't find complications such as pneumothorax, pneumomediastinum in our patients because we didn't use very high proximal airway pressure (PAP) and very high positive and expiratory pressure (PEEP).

Soporic, respiratory distress, hyperthermia

Cardiac complications may occur as the result of hypoxemia. Contributing to cardiac complications is the syndrome of sympathetic nervous system overactivity seen in some patients with severe tetanus (Cole, 1969).

Unexplained tachycardia may be seen as an early indication of the onset of this syndrome (Benedict and Kerr, 1977).

Most often it is manifested by temporary hypertension associated with high cardiac output. Other symptoms are myocardial irritability, profuse sweating in normothermic patients and hyperpyrexia in the absence of infection.

There is an increase in serum cortisol, cathecholamine and sodium retention (Level et al., 1970; Kelfty et al., 1968 and Holloway, 1970).

In our patients tachycardia and hyperthermia were also found, we didn't suspect that they were inclined to the syndrome of sympathetic overactivity, since in our patients severe infection was also present.

Vertebral fractures are often seen in thoracic vertebrae of patients with tetanus (Athavale and Pai, 1964). They usually do not result in neurological sequelae other than pain at the site of the fracture.

Our patients was diagnosed after chest x rays were performed. One of our patients died due to septicemia by pseudomonas bacteriae which were resistent to all kinds of antibiotics. Infection of gram negative bacteriae anl septicemia are known to become a problem in an intensive care unit (Stoddart, 1974).

We didn't find severe complication by using pentothal in our series except decrease of heart rates and some lowering of blood pressure.

Though the results of this report are not encouraging yet, this method seems to be a method which can be applied to overcome severe tetanus with mechanical ventilation, particularly when muscle relaxants such as curare and pavulon are unavailable.

TABLE 1: *Sex, age, indications, incubation period and "period of onset".*

Case	Age (year)	Sex	Indications	Incubation period in days	Period of onset in hours
1. R	6	Female	Recurrent-apnoeic attack	4	24
2. S	9	Male	Recurrent-apnoeic attack	7	48
3. S	11	Male	Recurrent-apnoeic attack	6	42
4. D	3	Female	Recurrent-apnoeic attack	7	48
5. I	11	Female	Recurrent-apnoeic attack	—	—
6. B	7	Male	Respiratory distress	7	36

TABLE 2: *Clinical symptoms and blood-gas analysis on admittance*

Case	Clinical symptoms on admittance	Blood-gas analysis			
		pH	PaCO2 (mmHg)	PaO2 (mmHg)	BE
1.	Soporic, respiratory distress, hyperthermia	7,44	29,5	81,2	-2,5
2.	Soporic, respiratory distress, hyperthermia	7,29	48,5	84,5	-3,2
3.	Soporic, respiratory distress	7,28	55,8	78,2	-8
4.	Apathetic severe convulsions	7,30	37,5	81,9	-6,9
5.	Soporic, respiratory distress, hyperthermia, severe convulsions	7,39	37	67,2	-2,3
6.	Soporic, respiratory distress, severe convulsions	4,42	37,5	63,2	-1,7

TABLE 3: *The duration of mechanical ventilation, results of treatment and complication.*

Case	Duration of mechanical ventilation (in days)	Results of the treatment	Complications
1.	8	died	— Bronchopneumonia (Staphylococcus)
2.	5	died	— Bronchopneumonia (Klebsiella + H. influenzae)
3.	24	alive	— Bronchopneumonia (Klebsiella + H. influenzae) * Compression fracture
4.	—	alive	—
5.	5	died	— Septicemia (Pseudomonas)
6.	29	alive	Bronchopneumonia (Staphylococcus).

REFERENCES

1. ADAMS, E.B.; HOLLOWAY, R.; THAMBIRAN, A.K.; and DESAI, S. B.: Usefulness of intermittent positive pressure respiration in the treatment of tetanus. Lancet ii : 1176 (1966).
2. ALFERY, D.D. and RAUSCHER, L.A.: Tetanus, a review. Crit. Care Med. 7 : 176 (1978).
3. ATHAVALE, V.B. and PAI, P.N. : Tetanus - clinical manifestations in children. J. Pediatr. 65 : 590 (1964).
4. BEATY, H.N. : Tetanus. In Harrison's Principles of Internal Medicine, p.p. 886 - 890 (McGraw Hill, New York 1977).
5. BENEDICT, C.R. and KERR, J.H. : Assessment of sympathetic nervous overactivity in tetanus. Br. Med. J. 2 : 86 (1977).
6. CARLOS, G.G.; KHAN, R.C.; GOLDINER, P.L..; HOWLAND, W.S.; and TURNBULL, : Longterm infusion thiopental. Hemodynamic and respiratory effects. Crit. Care Med. 6 : 311 (1978).
7. COLE, L.; and YOUNGMAN, H.R. : Sympathetic nervous overactivity in tetanus. Br. Med. J. 3 : 474 (1969).
8. HOFF, J.T. : Resuscitation in focal brain ischemia Crit. Care Med. 6 : 245 (1978).
9. HOLLOWAY, Status in tetanus. Lancet ii : 1278 (1970).
10. ILLIS, L.S. and TAYLOR, F.M. : Neurological and electroencephalographic sequalae of tetanus. Lancet i : 826 (1971).
11. KELLTY, S.R. GRAY, R.C. and DUNDEE, J.W. : Catchecolamine levels in severe tetanus. Lancet ii : 195 (1968).
12. LEVELL, M.J. STICH, S.R. and DYKES, J.R.W. : Adrenal cortical function in patients with tetanus. Br. J. Anaesth. 42 : 531 (1970).
13. SAFAR, P. : Brain resuscitation in metabolic toxic infectious encephalopathy, Crit. Care Med. 6 : 68 (1978).
14. SAFAR, P.; BLEYAERT, A.; NEMOTO, E.M;. MOOSSY, J. and SNYDER, J.V. : Resuscitation after global brain ischemia - anoxia. Crit. Care Med. 6 : 215 (1978).
15. STODDART, J.C. : Gram negative infections in the ICU. Crit. Care Med. 2 : 17 (1974).
16. TRUJILLO, M.J.; CASTILLO, A.; ESPANA, JV.; GUEVARA, P.; and EGANEZ, H. : Tetanus in the adult. Crit. Care Med. 7 : 419 (1980).