A TEN YEAR REVIEW OF THE MORTALITY AMONG TETANUS PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT AT KENYATTA NATIONAL HOSPITAL, NAIROBI.

BY

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THIS DISSERTATION IS MY ORIGINAL WORK AND HAS NOT, TO THE BEST OF MY KNOWLEDGE, BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

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LIST OF FIGURES, TABLES/APPENDIX

SUMMARY

A ten year retrospective study, running from 1980 to 1989; both years included, was undertaken at the Kenyatta National Hospital (K.N.H). This study was undertaken to find the mortality and assess the management of the patients admitted to the intensive care unit with tetanus.

A total of 90 files, out of the expected 115 (78.3%) were studied. The rest of the files were not traced.

MATERIALS AND METHODS

The patients were all cases of tetanus, admitted and managed in the intensive care unit (I.C.U). Their ages ranged from one year to seventy three years. An in-patient number was obtained from the I.C.U admission records. The number was then used to trace the file in the records department. Each file was then scrutinised carefully for the appropriate details which were noted on a data collection sheet.

Following admission to the I.C.U. most of the patients were managed in the same way using the Total paralysis Regime (T.P.R). Wound debridement was done where necessary, then tetanus toxoid (0.5 mls intra muscular stat) or Anti-tetanus serum (ATS'10000 to 15000 I.U; I.M.stat) was given. Sedation was undertaken either with diazepam (mainly), phenobarbitone or in a few instances, chlorpromazine (largactil). Some patients were known epileptics and therefore they required phenytoin.

The patients were intubated with the help of scoline and then put on non-depolarising agents, namely pancuromium bromide (Pavulon) or occasionally tubocurarine. The former was the most available agent. The patients were put on beta-blockade if the rate went above 120 beats per minute. the only beta-blocker employed was propranolol (inderal).

The patients were ventilated for varying periods using the intermittent positive pressure ventilation technique. The ventilators used included The Engstrom, East-Radcliffe and the Bennett which are pressure cycled.

The patients were also put on anti-biotics namely penicillin. This was however changed if the patient became infected with resistant organisms. Other anti-biotics used included Gentamicin, Kanamycin, Chloramphemicol, Ampiclox, flagyl (metronidazole), nitro-furantoin, Amikacin and Rocephin (Ceftriaxone) as well as Fortum (Ceftazidime). The complications were treated as they were encountered.

RESULTS

Only 90 files were available. The statistical analysis was therefore done on the basis of these 90 files.

The ages ranged from 1 year to 73 years. The Male to Female ratio was 3 to 1; with a total of 68 males and 22 females. The commonest portal of entry was the foot and this accounted for 42.2% of the patients. The leg was the next common portal of entry (12 patients) but this could not be elucidated in 11 patients (see table 3) (i).

The commonest type of injury appears to be septic or cut wounds (42.2% of the patients). Jigger sores accounted for 11 patients but the history of injury was unknown in 10 patients (see table 3 (ii)?

The incubation period was mainly between 1 and 10 days. This was the case in 47 patients (52.2%). In 13 patients the incubation period was between 11 and 20 days but in only 2 patients the incubation period was above 21 days. In 28 patients (31.1%) however, the incubation period could not be elucidated.

On the other hand, the period of onset was between 1 and 5 days in 60 patients (66.7%) but it was not known in 24 patients (see table 5).

Most of the patients were referred from other wards at K.N.H. and this accounted for 82.2% of the patients. Only 3 came directly from home and 13 were referred from peripheral (provincial or district) hospitals.

The duration of intubation ranged from 0 to 104 days. Of these 90 patients, 7 were managed conservatively for periods running from 7 to 23 days. The duration of stay in the ICU was between 1 and 111 days. The average was however 41 (SD $\pm$18.9) days for those who were discharged and 16 (SD $\pm$17.7) days for the deaths.

These patients also developed complications while they were undergoing treatment in the I.C.U. The commonest one was pneumonia which had a frequency of 70, followed by anaemia and rigidity respectively (see table 8).

On the prevention aspect, 10 patients were immunized, there was no history of immunization in 7 patients and this was unknown in 73 (81.1%) patients (table 9(i).

The duration of treatment before admission ran from 1 to 44 days. A total of 68 (75.6%) patients were admitted after 1 to 5 days of treatment to the I.C.U. (table 9(ii).

Of the 90 patients who were admitted and managed over this ten year period, 49 died and 41 were discharged through the medical wards. The mortality as calculated from the individual yearly mortality over this period was 59.8% (table 12).

The commonest cause of death was sympathetic overactivity which was responsible for approximately 53% of the deaths. The next one was chest infection (mainly pneumonia) which accounted for about 34% of the deaths (see table 11).

Most of the patients who were referred from other hospitals died 10 out of 13, (76.9%).

Of the 49 deaths, the history of immunization was unknown in 40 of them. This is approximately 81.6% of the deaths.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The following conclusions can be made from these results.

1. The Mortality has gone up since 1979 from 33.9% (14) to 59.8% (approx.60%). Elsewhere, the trend has been for the mortality to decline. It it important to point out that this is an average figure (see table 12).

2. The age group most affected seems to be the 30 years or below group. Elsewhere, as will be made clear, the elderly (65 years or more) are also affected.

3. The history of immunization was unknown in 81.6% of the patients who died. This implies that a significant proportion of the patients of tetanus were inadequately protected at the time of injury.

4. For the patients who died, the duration of stay in the I.C.U was longer than that of those ones who were discharged.

5. Most of the patients who were referred from other hospitals died. This was probably due to the advanced stage of the disease at which they came. Hence the prognosis was poor.

6. Most of the deaths resulted from sympathetic overactivity and this was followed by chest infection (mainly pneumonia).

   Haemorrhage per se, contributed to 4.1% of the deaths. Faulty Ventilators, respiratory failure per se, and embolism each contributed to 2% of the deaths.

RECOMMENDATIONS

1. Prevention of tetanus by active immunization and 5 or 10 year boosters is very important. This has also been emphasized in the past (14). The need for Health education stands out clearly. The target population are the adults since the programme for childhood immunization is being implemented effectively.

2. Effective control of autonomic overactivity in the tetanus patients should be reemphasised.

3. Use of better and effective anti-biotics to combat ventilator Associated pneumonia is vital and regular decontamination of the ventilators and the I.C.U ward in general should be done regularly. Strict observation of asepsis by the I.C.U. staff. Ventilator Associated pneumonia remains a problems in the Western world as well.

4. The peripheral hospitals should refer their patients as early as possible for them to benefit from I.C.U. management. A long term goal would be to build I.C.Us at each of the provincial hospitals. This is already underway.

INTRODUCTION

HISTORY

The history of tetanus as found in written documents started about 2400 years ago. The same can be divided into three periods. The first starts in the 4th century B.C. until 1884. That is, from the description of tetanus given by Hippocrates (10.67) to the work of Carle and Rattone who, in 1884 established the ae tiology of the disease. Kitasato isolated the causative organism in the same year (8). During this first period practically nothing was added to the Hippocrates statements.

The second period goes from 1884 through 1926; from th work of Carle and Rattone (10.67) to the prepartion of tetanus antitoxin, accomplished by Ramone and Zoller in 1926.

The third period is still in progress, from 1926 to the present. This period, now over 40 years old, entails outstanding discoveries and mistakes as well that still enlighten our work.

DEFINITION OF THE DIESEASE

Tetanus is an acute, often fatal disease caused by exotoxin produced in a wound by clostridium tetani. It is characterised by generalised, increased rigidity and convulsive spasms of skeletal muscles.

Clostridium tetani is a gram-positive, motile, drum-stick shaped rod. The manifestations of tetanus are due to the soluble exotoxin tetanospasmin. The organism also produces a haemolysin called tetanolysin. Tetanus toxin (tetanospasmin) is a neurotoxic protein of molecular weight 150000 daltons. Fragments

of tetanus toxin have been described and these have been used to characterise the structure and functional domain of the molecule.

Tetamus toxin binds to special polysialoganglio-sides of the G_{IB} series (10.60). Tetamus toxin is synthesized without a signal sequence as a single chain of 1,315 amino acids. The N-terminal moieties of its heavy and light chains display considerable homologies with botulinum A, B and E toxin (10.34). There is also growing evidence that tetamus toxin binding to neuronal membrances is dependent on a plasma membrane protein. This double-receptor model for the binding of tetamus toxin to nerve cells does not explain completely, the effects of the toxin.

The ternary complex, tetanus toxin-G_{IB} - protein receptor is thought to be the high affinity-low capacity, biologically productive, binding of tetamus toxin (10.60). This accounts for the absolute neurospecificity of the toxin because the protein is supposed to be present only on the nerve terminal. It also accounts for the potency of tetanus toxin because a double receptor provides a very high cell association content for the toxin even when the two single association steps are not very strong (10.60).

The pathogenic effect of tetanus toxin is generally believed to be predominantly due to interference with inhibitory synaptic transmission in the Central nervous system (10.63). It has been suggested that tetanus toxin reduces the release of gamma Aminobutyric Acid (GABA) at supraspinal sites. The latter is considered to be an inhibitory transmitter in the central nervous system (10.63).

Another well established fact is that tetanus toxin blocks cholinergic synaptic transmission at the central and the peripheral nervous systems.

Experiments in other organisms suggest that the tetanus toxin is more effective at the central than in the peripheral chrolinergic synapse.

It is clear from the foregoing description that the tetanus toxin acts at four areas of the nervous system; namely; motor-end-plates of skeletal muscles, the spinal cord, the brain and the sympathetic nervous system (19).

Infection can occur by trauma, foreign body introduction, development of suppuration, and reducing local Redox potential (Eh) by Vegetative forms leading to toxin release (2.14). Other injuries and accidents which may lead to tetanus include burns, human bites, unsterile surgery, injection, fractures, otitis media, chronic skin ulcers, gangrenous limbs and eye infection (4).

EPIDEMOLOGY

Annual World mortality from tetanus is estimated at between 50,000 and 2,000,000 (4). Many socio-economic, traditional and Health management factors influence morbidity and mortality in Africa. These include, low literacy rate among women, strong taboos, poor health infrastructure, frequent injuries, poor access to health care and low immunization coverage. The disease is also grossly under-reported (10.20). In the majority of European countries this phenomenon progressed by evolution even before the era of active immunisation.

The second world war has interfered in this process and there was an increase in tetanus morbidity and mortality in Austria, Denmark, Finland, United Kingdom, Yugoslavia and other countries (10.20). In the 1951-1960 decade, the mortality due to tetanus was 0.81 per 100,000 inhabitants. In 1985 the tetanus morbidity and mortality decreased four fold (10.20).

Non-neonatal tetanus still remains an important cause of morbidity and mortality in South East Asia (10.46). The fatality rate was reported to be 24.1% in Korea in the decade 1974-1983 (10.45).

In the U.S.A, there were more than 100 cases each year with a mortality exceeding 60% in the early seventies (4). With the advent of mass immunization, reported incidence rates have dclined approximately ten-fold, through 1976 and have been relatively constant since then at 0.03 to 0.04 per 100,000 people (10.98). the main problem remains with people who are 60 years old or more. They have more than double the risk over all other age groups (10.98).

CLINICAL FORMS OF TETANUS

There are three forms of tetanus; local, generalised and cephalic tetanus. Local tetanus is characterized by persistent unyielding rigidity of the group of muscles in close proximity to the site of injury. It carries a low mortality (19).

Generalised tetanus constitutes 80% of the cases. 50% of the patients present with trismus. Other features include restlessness, irritability, stiffness of the neck, rigidity of abdominal muscles and difficulty in swallowing (19). Dysphagia

has been reported to be the sole symptom in one case (32). A typical tetanic seizure is characterized by a sudden burst of tonic contraction of muscle groups causing opisthotonos, flexion and adduction of the arms, clenching of the fists on the thorax and the extension of the lower extremeties. The patient is usually conscious and experiences a lot of pain. Dysphagia may occur and lead to hydrophobia. The body temperature may be elevated by 2^{o} to $4^{o}C$ above the normal. Glottal or lanyngeal spasm may lead to Asphyxia. Dysuria or urinary retention may occur. Cephalic tetanus results from head injuries and infections of the eye and orbit. It may also follow otitismedia (4). the incubation period is one to two days. It carries a poor prognosis. It is characterized by the dysfunction of the third, fourth, seventh, ninth, tenth and twelfth cranial nerves, singly or in any combination. The seventh nerve is affected most often (19).

DIAGNOSIS OF TETANUS

This is usually by history and clinical examination and only 30% of the cases of tetanus may be diagnosed by the laboratory.

MANAGEMENT OF TETANUS

This has been reviewed over many years. It depends on the severity of the disease. There are three grades (2).

GRADE 1. Mild:

This is characterized by mild to moderate trismus and general spasticity, little or no dysphagia, and no respiratory embarrassment. The incubation period (injury to first symptom)

is above two weeks. The period of onset (first symptom to first spasm) is more than 6 days. Localised stiffness near the injury may occur. The disease may progress to generalised rigidity by hours or days.

GRADE 2. Moderate:

In this grade or category, Moderate trismus and general spasticity, some dysphagia and respiratory embarrassment, and fleeting spasms occur. The incubation period ranges from 10-14 days. The period of onset is 3 to 6 days. The vital capacity is reduced. The minute volume at rest is normal.

GRADE 3(a)

The sysmptoms in this grade are severe trismus and general spasticity, severe and prolonged spasms (both spontaneous and on stimulation), severe dysphegia and respiratory difficulties.

The incubation period is less than 3 days and the period of onset is three days or less.

GRADE 3(b). Very Severe

Symptoms are as for severe tetanus plus autonomic dysfunction, particularly, sympathetic overactivity.

Similarly, the disease is managed according to the severity. This can be outlined as follows:

GRADE 1. Mild:

These patients present little problem. Diazepam helps to relieve the symptoms of trismus and spasticity and once it is established after a few days observation that the disease is not progressing beyond grade 1 the patient may be allowed to take a light diet. In general the aim of symptomatic treatment is to keep the patient alive and reasonably comfortable until remission occurs in 2-4 weeks. Where necessary wound toilet is done and then the patient immunized with Tetanus toxoid or Human tetanus immunoglobulin or Anti-tetanus serum (ATS). the latter is given after testing for hypersensity to horse serum. Even then, cases of delayed hypersensitivity have been reported and facilities for resusatation must be at hand. Benzyl pencilillin is given 6 hourly for at least one week. Results of intra thecal ATS obtained by Sanders et al (1977) with a mortality of 7% are yet tobe confirmed.

GRADE 2. Moderate

In addition to the Grade 1 management, tracheostemy is needed for ventilation and physiotherapy. A nasogastric tube is also passed for feeding.

GRADE 3(a) Severe:

Management includes the Grade 2 management as well as neuromuscular blockade and artificial ventilation. The longer acting competitive blockers are usually used; curare if there is tachycardia and hypertension, and pancurorium if there is bradycardia and hypertension. In a series done at the Leeds

infirmary, patients paralysed for short periods had less severe tetanus, requiring paralysis only at the peak of their illness. Those paralysed for longer periods had developed intercurrent problems delaying their weaning.

GRADE 3(b)

This invoves the management in Grade 3(a) and the control of autonomic dysfunction. This can be achieved in 2 ways.

(i) Heavy sedation with diazepam or even chlorpromazine. Analgesia and further sedation can be provided by a regular dosage of opiates. Anaesthesia is completely effective but most agents are too toxic for long term use. However nitrous oxide can be used intermittently to cover the worst periods.

(ii) Use of adrenergic neurone blockers propranolol or labetalol.

(iii) The third approach combines the first and the second one.

In addition, control of fluid balance, electrolysers and nutrition are mandatory. About 6-8 litres of intravenous fluids may be required in the acute phase. Currently, a lot of effort is being directed towards immunization. For a long time, it had been assumed that there is no naturally acquired immunity to tetanus (10.96). However a concept of naturally acquired immunity on tetanus has been adopted since 1966 (10.96). This has been supported by evidence from the third world. Among the queries which had remained unanswered before this concept was adopted are;

(i) Different responses to the tetanus toxoid.

(ii) Different severity and clinical forms of tetanus (including localized forms).

(iii) Absence of immunity after clinical tetanus and absence or relatively low prevalence of tetanus, either in humans or animals, in tetanus-prone epidemiological areas of the world.

Guidelines for tetanus vacination vary between countries. In some countries it is recommended with 3 vaccinations in childhood and boosters every 5 to 10 years, others do not recommend general vaccinations at all as is the case with Denmark (21).

COMPLICATIONS OF TETANUS:

RESPIRATORY:

These include retained secretions, atelectasis, pneumonia, tension pneumothorax, tracheal obstruction by secretions, tracheal bleeding, due to cuff and suction catheters and ventilation or respirator failure.

CARDIOVASCULAR

They include tachycardia (over 120 beats per minute), labile hypertension, peripheral vasoconstriction, myocardial irritability, peripheral oedema, Deep Venous thrombosis and pulmonary embolism.

GASTROINTESTINAL AND METABOLIC:

These include gastrointestinal stasis, acute gastric dilatation, paralytic ileus, gastrointestinal haemorrhage, constipation, jaundice, weight loss and anaemia. Urinary tract infection is a common complication. Other complications include muscular rigidity, contractures, cranial nerve palsies, disorientation, emotional lability and depression.

The management of complications of tetanus needs mention because it contributes significantly to morbidity and mortality.

Diazepam has been found to combine both sedative and muscle relexant actions with longer duration. It is the main drug used to control spasms but it has no effect on autonomic overactivity. Successful treatment of severe cases of tetanus has been reported. In one such case a combination of propranolol and bethanidine was used (15, 22, 5).

Embolism is prevented by anti-coagulation therapy. Low dose subcutaneous heparin (5000 i.u.b.d.) has been reported not to prevent the development of emboli (11).

HYPOTHESIS

The survival of severe tetanus patients in the Eighties and Nineties should be better in the K.N.H. I.C.U. than in the seventies. This can be said in view of the rapid advances in medical technology resulting in better equipment and hence management. If this is not the case and indeed it is not, then we need to know where we are going wrong.

Furthermore concern has been expressed during I.C.U. weekly mortality meetings, that mortality is rising. This is by casual observation. In a sturdy done by Nganga (14) from 1975 to 1979, both years inclusive, he found that the mortality rate associated with tetanus in the I.C.U. was 33.9%.

This study does not differ from the previous ones and indeed it is a continuation with the main reason cited above.

OBJECTIVES:

(1) To determine the mortality in the Eighties which has been tending to rise.

(2) To establish the cause of this mortality, dspite a decline in the number of admissions.

(3) To suggest some amendments in the management in order to improve the survival.

(4) To write a dissertation which will be submitted in part fulfilment for the degree of Master of Medicine (Anaesthesia) in the University of Nairobi.

MATERIALS AND METHODS:

A data collection sheet (see appendix I) was used to go through the patients files. These files were obtained, with express permission, from the ethical committee and the records department at the Kenyatta National Hospital.

The data obtained was then subjected to descriptive statistical analysis and comparison was made with similar data as reported from other centres.

Following admission to the I.C.U., the patients were managed as outlined below.

Wound debridement was done where the portal of entry was identified. This also included removal of a foreign body if it was found. The patient was then given either Tetanus Toxoid or Anti-Tetanus Serum. The usual doses were 0.5mls stat of Tetamus toxoid and 10000 to 15000 i.u of Anti-Tetanus Serum.

Sedation was also given. The commonest agent used was diazepam. Other agents used included phenobarbitone and chlorpromazine. Anti-epileptics were given to known epileptics. The drugs used included phenytoin and carbamazepine.

On arrival, some patients were already intubated but for those who had not been intubated, it was done with the help of suxamethonium, diazepam or thiopentone. To enable intermittent positive pressure ventilation to be given, a non-depolarising relaxant was given on a regular basis after a stat dose. The intervals between does were 2 to 4 hours.

The commonest drug used was pancuronium bromide. Tubocurarine has been in short supply for a long time. The ventilators used to deliver positive pressure ventilation were the Angstrom, East Radcliffe, and the Bennet. all are presure cycled ventilators. Intravascular access was made possible by the use of plastic cammulas which were introduced and secured in peripheral veins. A nasogastric tube was passed following intubation, for suction and feeds; where these could be tolerated. The patients were put on Benzyl pencillin but this was changed when the patients developed secondary infection. Diagnosis of Secondary infection was made by culture of tracheal aspirates. Other antibiotics used included Amikacin, Ampiclox, Ceftriaxone and Ceftazidime. These patients were monitored continuosly while undergoing treatment. The heart rate was monitored by continous Electrocardiography; the blood pressure by the Cuff method and the temperature by the use of clinical thermometers. Ventilation was controlled and hence the rate was preset. The blood gases were analysed on a 4 to 6 hourly basis to determine the adequacy of alveolar ventilation and to rectify any abnormalities. Electrolytes were monitored in a similar manner. The patients were turned every 2 hours to prevent pressure sores. They were also fed on diets prescribed by the I.C.U. nutritionist (see table below).

Total parenteral hyperalimentation was adopted where there was proof of gastrointestinal stasis. It was not possible to get the nutritional prescriptions from the patients files. However, parenteral feeds were unavailable most of the time and the patients were put on 10% dextrose alternating with normal saline.

This was especially so in the first and second week after admission. Where need arose, anti-coagulation therapy was given. Beta-blockade was used to control tachycardia. Chest physiotherapy was given on a 4 to 6 hourly basis.

Finally other complications were dealt with as they were encountered.

ALLOWANCE FOR ONE PATIENT IN ICU

HIGH PROTEIN AND HIGH CALORIE FEED

INGREDIENTS	AMOUNT	CHO(G)	FAT(G)	PROTEIN(G)	CALORIES
WHOLE MILK	2250 MLS	60	46.3	42.5	825
D.S.M. POWDER	120 G	62.2	1.2	43.5	428.4
EGGS	150 G	-	17.2	19.5	227
SUGAR	120 G	120	-	-	480
CORN OIL	120 G	-	120	-	1080
TOTAL	-	142.2	148.7	105.5	3040.4

After mixing the above ingredients,

100 mls of the mixture yields the following;

Proteins - 5g Fat - 8g

Carbohydrate (CHO) - 19 g Calories - 135

RESULTS

Of the 115+ expected files,only 90 were availed by the records department. This represents 78.3% of the expected number. The remaining 25 files were not traced. The statistical analysis was, therefore, done on the basis of these 90 files

The youngest patient was 1 year of age and the oldest one 73 years of age. Most of the patients were between 1 and 20 years. A total of 59 patients fell within this range with the 11 to 20 year age group having a slight edge (See table 1). In general most of the patients were 30 years or less. This represents 81.1% of the total number of patients.

There was a male sex preponderance and the males were 3 times as many as the females. There was a total of 68 male patients and this accounted for 75.6% of the patients. On the other hand there were only 22 female patients representing 24.4% of the patients.

The commonest portal of entry was the foot and this was true for 42.2% of the patients. The next one was the leg which took up 13.3% of the patients. However, the portal of entry was unknown in 11 patients. The head was the portal of entry in 7 patients (See table 3(i).

The commonest type of injury appears to have been prick wounds which later became septic. This was followed by cut wounds and jigger sores. Altogether, this represented 54.4% of the patients. There was no history of injury in 10 patients (See table 3(i).

The incubation period fell between 1 and 10 days in 52.2% of the patients. However, the incubation period could not be elucidated 31.1% of the patients, mainly because the history given was unreliable. A long incubation period does not obviate severe tetanus (See table 4).

Conversely, the period of onset fell between 1 and 5 days in 66.7% (60) of the patients. However, the period of onset was unknown in 26.7% (24) patients (See table 5).

There were three sources of tetanus patients admitted to the I.C.U. Most of the patients came from other wards at K.N.H. and this accounted for 82.2% (74) of the total number of patients. Only 3 patients were admitted directly from home. Other hospitals contributed 14.4% of the tetanus patients admissions.

Seven patients were not intubated and 83 patients were intubated. The seven patients were managed conservatively for periods ranging from 7 to 23 days. The duration of intubation varied from 0 (no intubation) to 111 days. 33.3% of the patients remained intubated for up to 10 days; while 20% remained intubated for 11 to 20 days. 26% of the aptients remained intubated for 31 to 50 days (see table 74).

The length of stay in the ICU was also noted. The distribution of stay was more or less uniform. (see table 7B). However 61.6% of the patients stayed for periods ranging from 1 day to 30 days. On the development of complications, the commonest one was pneumonia which had a frequency of 70 (table 8). The organisms isolated by culture of tracheal aspirates included; Klebsiella species, pseudomonas aeruginosa, proteus species, Escherichia Coli, Staph aureus and even pneumococci and acinetobacter*.

Pneumonia was was followed by anaemia, rigidity and autonomic imbalance. The frequency refers to the number of times a complication occurred. For instance, pneumonia occurred in 70 patients (see table 8). On the prevention aspect, the history of immunisation was unknown in (73) 81.1% of the patients and there was a positive response in 11.1% (10) of the patients (table 9(i).

On treatment before admission, 75.6% of the patients gave a history of treatment for up to 5 days (see table 9(iii).

Of the 90 patients considered in this study, 49 died and 41 were discharged through other medical wards. The mortality, on a yearly basis, varied from approximately 23.1% (1981) to 80% (1985) with an average of 59.8% for the decade spanning 1980 to 1989.

The cause of death was known in most patients. Approximately 53% of the deaths were secondary to sympathetic overactivity while 34.7% of them were secondary to pneumonia (see table 11). The cause of death was, however, unknown in 2% of the patients.

Post mortem reports were lacking in most files. The probable reason could have been failure to request for postmortem. The origin of the tetanus patients who were admitted to the I.C.U. has been mentioned. It was noted that all the patients who came from (3) home were discharged. For those referred from other wards at K.N.H., there was no significant difference between the deaths and discharges. A highly significant proportion of tetanus patients who were referred from other hospitals died.

There were 13 patients and 10 of them died (76.9%). It was also mentioned that long acting muscle relaxants were used. The main one employed was pancuronium bromide. For those patients who died, the average duration of paralysis was 10 (SD±5.5) days but on the other hand, those who survived and were discharged, had an average duration of 30 (SD± 7.2) days. This difference is highly significant. Likewise, the average duration of stay in the ICU for those who were discharged was 41 (SD±18.9) days and for those who died, it was 16 (SD±17.7) days. Again, this was highly significant.

Out of the 41 patients who were discharged, 28 of them (68.3%) had rigidity. Only one patient among the deaths had this complication. Finally, the history of immunization was unknown in 40 (81.6% approx.) out of the 49 patients who died. This was highly significant.

DISCUSSION

A lot of work has been done on non-neonatal tetanus. The disease is said to be rare in the Western world (24) but this is not true for the developing countries where it still poses a considerable Health risk. In a five year Retrospective Study, done by Nganga over the years 1975 to 1979 (14), the mortality was approximately 33.9%. This did not include deaths from late complications after discharge which comprised a small percentage. Nganga made several suggestions that are already in effect. These included prophylaxis following injuries, use of ventilator alarms, use of prophylactic anti-coagulant therapy and effective control of autonomic overactivity. Considering the current study, the mortality has gone up to 59.8% (approx) and the major problem seems to be failure to control autonomic overactivity effectively. Again, several studies have been done on this problem. It is reported from Switzerland that autonomic overactivity could respond to labetalol. The latter is a mixed alpha and beta blocker. A similar report had been made by Dundee (5). The predominantly beta-blocker propranolol (inderal) has been extensively used in our set up. There is little experience with labetalol. From the Leeds Infirmary, Edmondson and Flowers reported a mortality of 10% in 100 cases, in a retrospective study done from 1966 to 1971 (6). This study concluded that, in order to have such a favourable mortality full intensive care facilities with a trained nurse to care for each patient must be available at all times. At present, our I.C.U. has a nurse to patient ratio of 1 to 2. This has been possible because of the

current training programme. About 63.7% of the nurses have had I.C.U. training. Furthermore, Atrachki and Wilson reported a mortality of 13% in 59 patients over the years 1966 to 1976 at the General infirmary in Leeds (1). The Study stressed the importance of preventive measures within the susceptible population. In the current study, it was noted that 81.6% of the patients, who later died, did not give a history of immunization.

Working in a similar way, Singh, sikka and Gupta at Rajendra Hospital (India) reported a mortality ranging from 7.18 to 90.90% among 100 patients. This study was based on a scoring system which was used to plan the management according to the severity of the disease (20). Likewise, records of 228 patients seen at the Lagos Hospital (University) were reviewed. The period spanned the years 1967 to 1976. 67.6% of the patients were under 30 years of age and the incidence was maximal in the 11 to 19 year age group. The disease was more common in the dry season of the year, December to February than in the rainy season, May, June, and July. The treatment was, however conservative and the mortality was 30.2% (23). In the current study, the 11-20 year age group had a slight adge over the others. As it was shown, about 81.1% of the patients were 30 year or less.

A national surveillance of tetanus in England and Wales from 1930 to 1979 revealed that the incidence of tetanus is highest in people over 65 years of age in whom death rates are also highest and in young males aged 15-44 years (26,33). A similar trend has been noted in the current study.

In the present study, the next likely cause of death after sympathetic overactivity was pneumonia. Hospital acquired pneumonia is an important cause of morbidity and mortality among I.C.U. patients and its incidence has not been reduced by developments in medical technology (25). Difficulties with diagnosis and conventional Anti-microbial therapy in Ventilator associated pneumonia have led to the development of new diagnostic techniques such as bronchoalveolar lavage and the bronchoscopic protected specimen brush. Still a lot needs to be done (25).

In our set up, the diagnosis was made on the basis of a chest-X-ray and Tracheal Aspirate Cultures. The organisms isolated here have already been mentioned. Despite sensitivity tests and conventional treatment, pneumonia claimed approximately 34.7% of the deaths. Furthermore, there have been reports of adjunctive use of Dantrolene in severe tetanus (27). In this (current) study, 2 patients had renal failure. This makes the prognosis worse (29,31).

Recently, at the Caracas University hospital, in Caracas Venzuela, a study was done to determine the impact of intensive care management on the prognosis of tetanus. This impact has been manifested in a decrease in mortality from 43.5% to 15%. Furthermore, while patients treated conservatively died as a consequence of early acute respiratory failure, the main cause of death in the ICU - treated patients with tetanus was autonomic overactivity. This has also been demonstrated in the present study. It was concluded that to ensure a high survival rate in patients with tetanus, the treatment must be performed according to an established protocol in an ICU (34).

It has already been pointed out that the search for the management of tetanus still goes on. Studies have been done on the intrathecal use of Baclofen in tetanus. Muller et al concluded that local application of Baclofen may prove to be an advance in the management of tetanus. Long term sedation and respirator therapy, along with its complications, can be avoided. Using this technique, the disease seems to run a shorter course (35). However, they cautioned that evaluation is needed. In that study, only two patients were involved. On the other hand, the use of vecuromium in the management of severe tetanus has been reported (36). The use of vecuromium helps to minimise the Cardio-Vascular disturbances which accompany the disease. This can be administered as an infusion.

Similarly, a lot of work has been done on the prevention aspect of this disease. It is accepted that the level of tetanus antibody cannot be used as a diagnostic test for the disease. Also, an attack of tetanus does not necessarily result in a rise in tetamus anti-toxin antibody levels (37). At present immunisation holds an upper hand in stemming this disease. The major question lies in how to administer the vaccine to adults who have not been immunised.

A lot of suggestions have been made on immunisation (38, 39, 40). The general consensus is that it is necessary to give the anti-tetanus vaccine but the main point of contention is cost. It has been suggested that the patients could be selected when they pay routine consultation visits at the clinics. At least one centre has reported a favourable response over 5 years (38,39,40). It

is suggested that the initial course of 3 injections should be followed by a booster dose every 10 years; but there is no need to start a fresh course when an earlier series of injections has lapsed (41). Hence surveillance and prophylaxis must be done if the coverage of immunity is to be adequate. The optimum policy, therefore, should be to achieve total immunisation uptake in childhood and maintain high standards of normal treatment (42).

Hence, tetanus prophylaxis can be undertaken if the following points are observed:

1. Active immunisation provides the best and safest protection against tetanus.

2. Wounded patients who are known to be actively immune do not usually require passive protection but may be given a re-enforcing dose of tetanus toxoid at the time of treatment.

3. All wounded patients should be treated surgically. The tetanus-proneness of a wound is determined after surgical toilet in the light of factors such as the success of surgery, the extent of remaining contamination, the age of the injury, the presence of wound infection, the possibility of a retained foreign body and the immune state of the patient.

4. For non-immune patients with a tetanus-prone wound passive protection is required as is best provided by human anti-tetanus immunoglobulin. If human anti-toxin is not available, heterologous anti-toxin should be used.

5. Treatment with heterologous anti-toxin should be preceeded by a test-dose. Should a hyper-sensitivity reaction develop, further horse or other foreign serum should not be given. Anti-microbials must be used.

6. When passive protection is given, it is accompanied by a first dose of adsorbed toxoid administered quite separately from the anti-toxin.

7. Tetanus-toxoid injected for the first time into a non-immune individual at risk from tetanus provides no protection against the rist at this time.

8. If any anti microbials are used, as prophylaxtic agents, they must be given in adequate doses for an adequate time. Systemic anaerobicidal anti-microbials are advisable before surgical toilet in badly soiled or severe injuries. Flagyl and benzyl pencillin are the drugs of choice. However, a recent study in the K.N.H. I.C.U. (1990) revealed twelve different pathogens that cause respiratory track infection in patients with endotracheal tubes. They included Acinetobacter and the ones mentioned earlier. None of these pathogens was sensitive to Benzyl pencillin and none was found to be predominant because the study was inconclusive (44).

Lastly, adults with AIDS may have a defective tetanus immune response. This has so far been demonstrated in children. However, AIDS patients lacking a three-dose primary series of tetanus toxoid should complete such a series using an age appropriate preparation. Boosters should be administered as suggested earlier (43).

CONCLUSIONS AND RECOMMENDATIONS

The following observations can be made from these results:

1. The mortality has gone up, since 1979, from 33.9% (14) to 59.8% (nearly 60%, current study). Elsewhere in the world, as pointed out in the discussion, the trend has been for the mortality to decline. This is a mean figure and this is clearly shown in table 12.

2. The 30 years or less age group seems to be the most affected one. Elsewhere as pointed out earlier, the elderly (65 years or more) are also affected.

3. Out of the 49 deaths, 40 of them were not known to have been immunized. This is a significant proportion.

4. The commonest cause of death was autonomic hyperactivity followed by pneumonia.

5. Most of the patients who were referred from other hospitals died.

RECOMMENDATIONS

1. The prevention of tetanus by active immunisation and 5 or 10 year boosters should be emphasised. Health education, particularly of the adult population is highly recommended.

2. Effective control of autonomic overactivity in the tetanus patient and treatment of pneumonia. The sensitivity of the organisms must be sought before patients are given anti-biotics.

3. At present, every patient who has been admitted to the I.C.U. has one suction tray for 24 hours. Suckers are however, shared and suction catheters are re-used after sterilisation. Instead of wearing gloves before handling suction catheters, sterile forceps are used to hold these catheters. Sterilisation of suction catheters, tubes and other instruments is done by autoclaving or soaking in anti-septic solutions. This approach clearly promotes secondary infection. Strict observation of asepsis is therefore required. This could be achieved by use of disposable material.

4. The peripheral hospitals should refer their patients as soon as possible for a favourable outcome. Each provincial hospital, as a long term solution, needs an I.C.U. This is already underway.

FIGURE 1

OVERALL AGE DISTRIBUTION

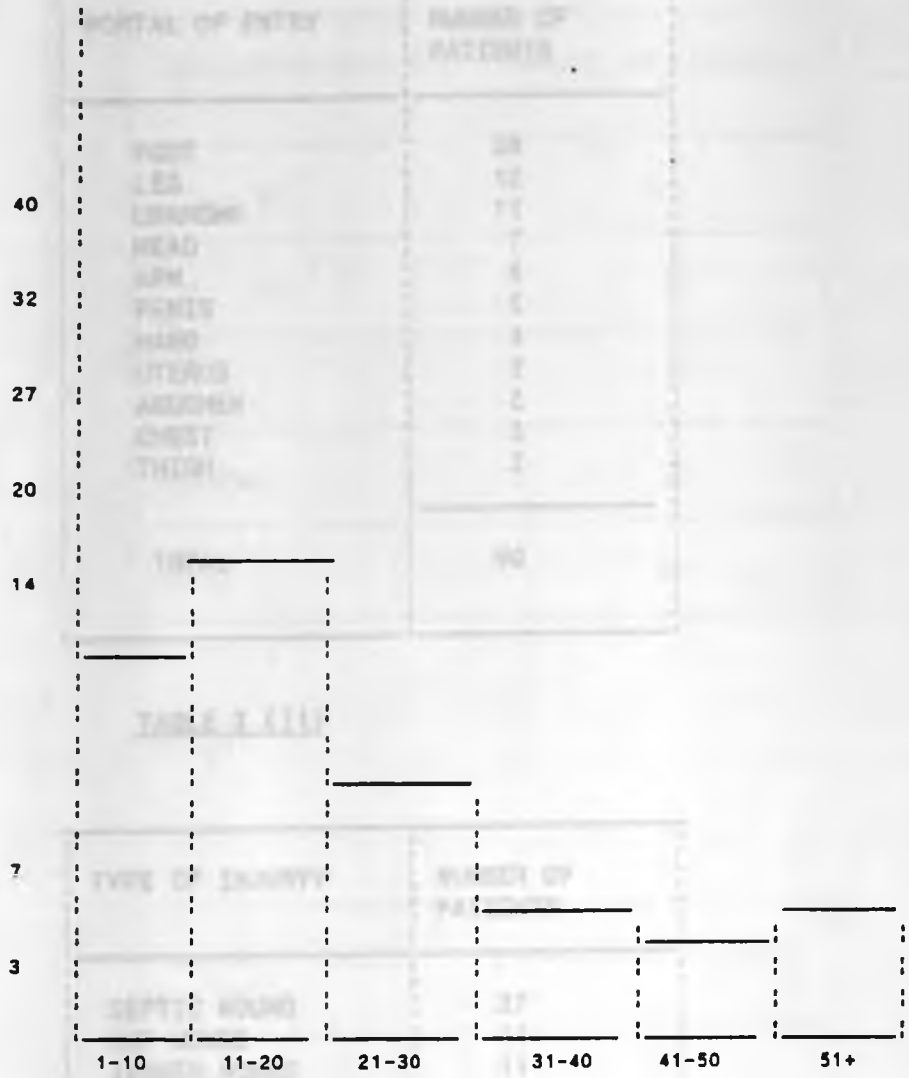


TABLE 2

SEX	NUMBER OF PATIENTS
MALE	68
FEMALE	22
TOTAL	90

TABLE 3(i)

PORTAL OF ENTRY	NUMBER OF PATIENTS
FOOT	38
LEG	12
UNKNOWN	11
HEAD	7
ARM	5
PENIS	5
HAND	4
UTERUS	2
ABDOMEN	2
CHEST	2
THIGH	2
TOTAL	90

TABLE 3 (ii)

TYPE OF INJURYY	NUMBER OF PATIENTS
SEPTIC WOUND	27
CUT WOUND	11
JIGGER SORES	11
UNKNOWN	10
STAB WOUND	9
COMPOUND FRACTURE	8
CIRCUMCISION	5
BURNS	2
DOG BITE	2
ABORTION	1
CRUSH INJURY	1
PUERPERAL SEPSIS	1
GUNSINT WOUND	1
PRICK WOUNDS	1
TOTAL	90

TABLE 4

INCUBATION PERIOD (DAYS)	NUMBER OF PATIENTS
1 - 10	47
11 - 20	13
21+	2
UNKNOWN	28
TOTAL	90

TABLE 5

PERIOD OF ONSET (DAYS)	NUMBER OF PATIENTS
1 - 5	60
6 - 10	5
11+	1
UNKNOWN	24
TOTAL	90

TABLE 6

REFERAL FROM	NUMBER OF PATIENTS
HOME	3
OPTHER WARD (KNH)	74
OTHER HOSPITAL	13
TOTAL	90

FTABLE 7(A)

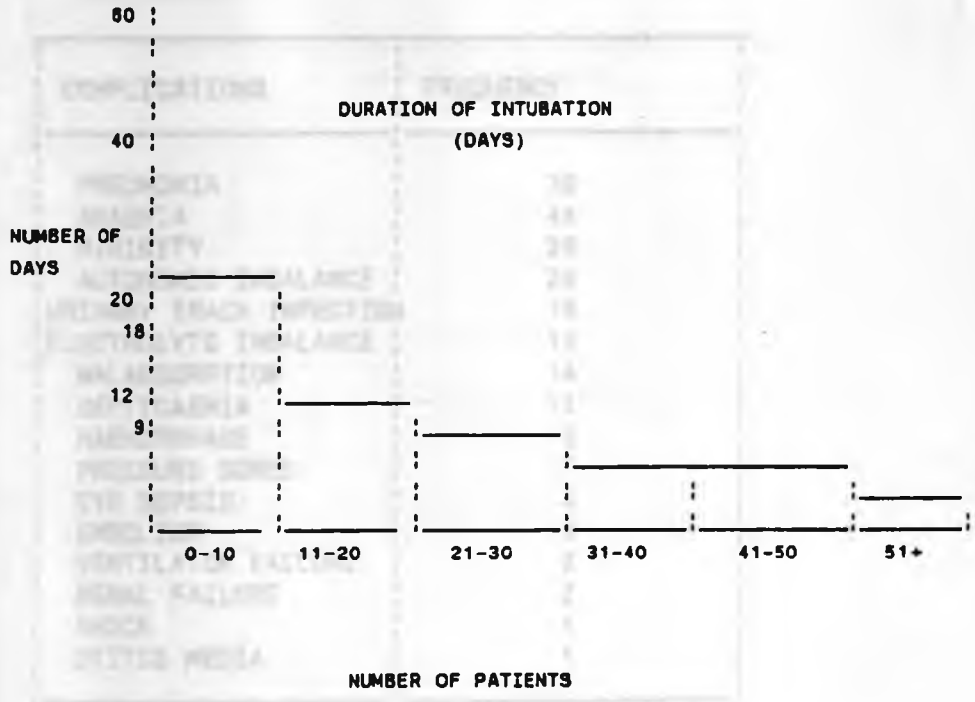


TABLE 7B

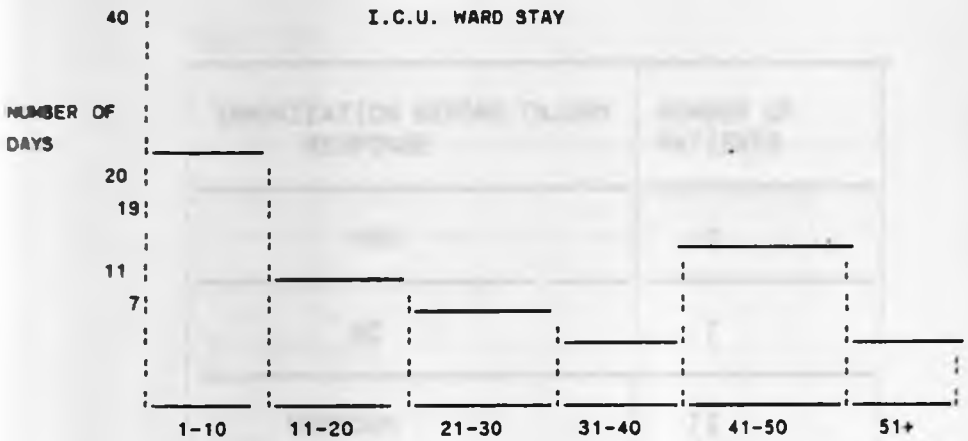


TABLE 8

COMPLICATIONS	FREQUENCY
PNEUMONIA	70
ANAEMIA	44
RIGIDITY	29
AUTONOMIC IMBALANCE	26
URINARY TRACK INFECTION	18
ELECTROLYTE IMBALANCE	19
MALABSORPTION	14
SEPTICAEMIA	13
HAEMORRHAGE	9
PRESSURE SORES	7
EYE SEPSIS	4
EMBOLISM	3
VENTILATOR FAILURE	2
RENAL FAILURE	2
SHOCK	1
OTITIS MEDIA	1

TABLE 9(i)

IMMUNIZATION BEFORE INJURY RESPONSE	NUMBER OF PATIENTS
YES	10
NO	7
UNKNOWN	73
TOTAL	90

TABLE 9(ii)

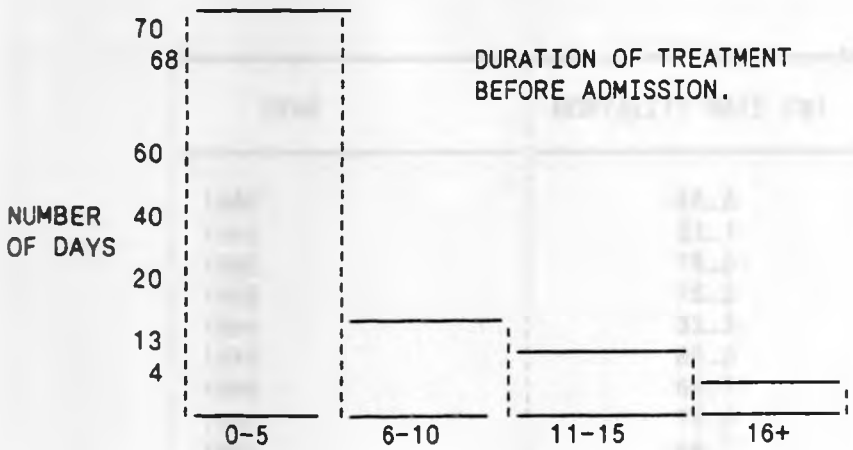


TABLE 10

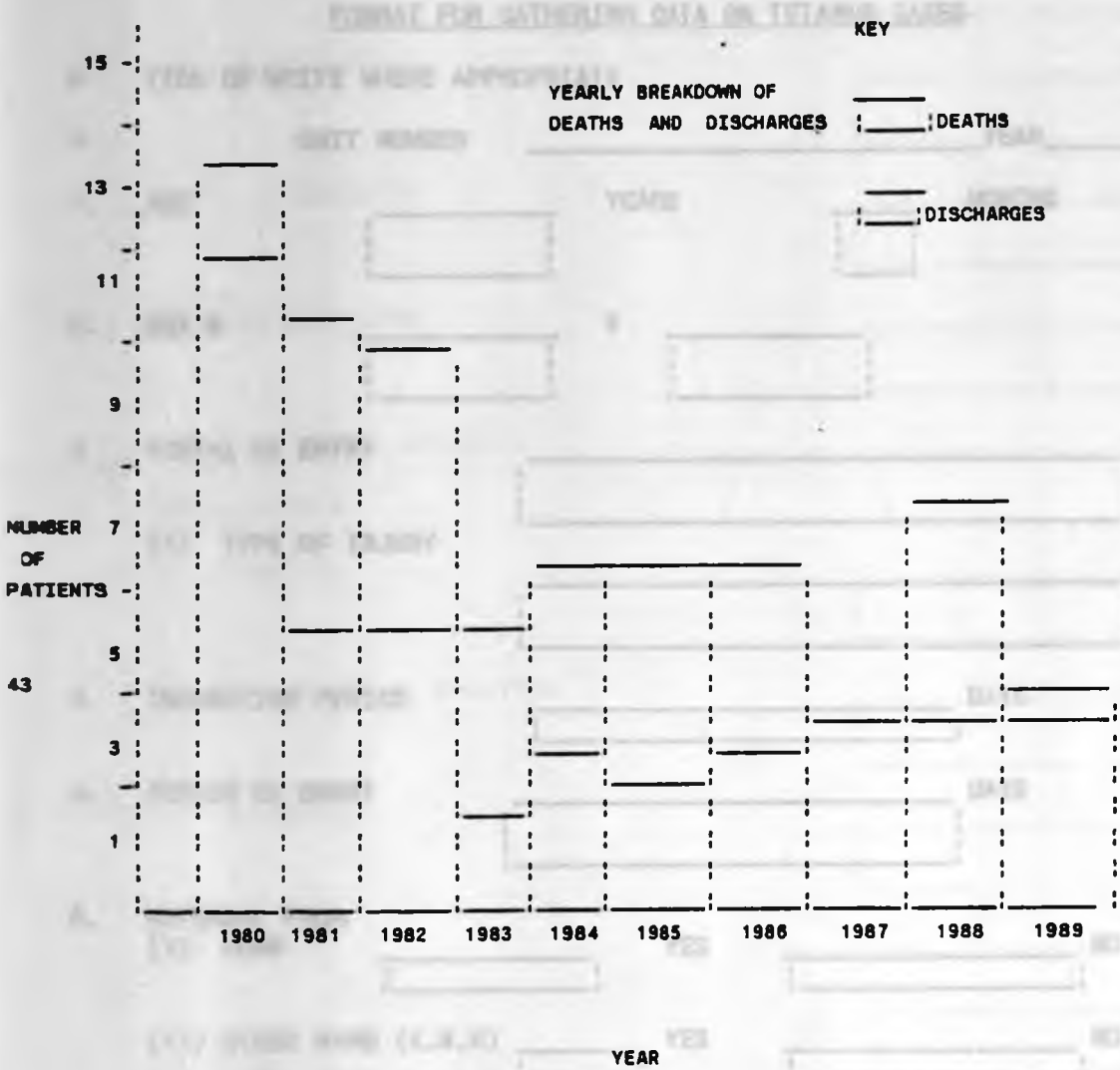
CAUSE OF DEATH	PERCENTAGE (%)
AUTONOMIC IMBALANCE	53
CHEST INFECTION	34.7
HAEMORRHAGE	4.1
FAULTY VENTILATOR	2.0
RESPIRATORY FAILURE	2.0
EMBOLISM	2.0
UNKNOWN	2.0

TABLE 11

MORTALITY RATE BREAKDOWN

YEAR	MORTALITY RATE (%)
1980	45.8
1981	23.1
1982	75.0
1983	75.0
1984	33.3
1985	80.0
1986	66.7
1987	75.0
1988	66.7
1989	57.1
MEAN	59.8

FIG. 12


KEY
YEARLY BREAKDOWN OF
DEATHS AND DISCHARGES
DEATHS
DISCHARGES
15
13
11
9
7
5
3
1
NUMBER OF PATIENTS
43
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
YEAR

APPENDIX I

FORMAT FOR GATHERING DATA ON TETANUS CASES

* TICK OR WRITE WHERE APPROPRIATE

* UNIT NUMBER _____ YEAR _____

1. AGE _____ YEARS _____ MONTHS

2. SEX M _____ F _____

3. PORTAL OF ENTRY _____

(i) TYPE OF INJURY _____

4. INCUBATION PERIOD _____ DAYS

5. PERIOD OF ONSET _____ DAYS

6. REFERRAL FROM

(i) HOME _____ YES _____ NO

(ii) OTHER WARD (K.N.H) _____ YES _____ NO

(iii) OTHER HOSPITAL _____ YES _____ NO

7. MANAGEMENT

(i) WOUND DEBRIDEMENT _____

(ii) TETANUS TOXOID/ANTITETANUS SERUM _____

(iii) SEDATION _____

(iv) TRCHEOSTOMY/INTUBATION _____

(v) PARALYSIS _____

(vi) B-BLOCKADE

(vii) VENTILATION

(viii) ANTIBIOTICS

(ix) ICU WARD STAY

(x) OTHER (SPECIFY) _____

8. COMPLICATIONS

(i) RIGIDITY

(ii) URINARY TRACT INECTION

(iii) PNEUMONIA

(iv) ANAEMIA

(v) EMBOLISM

(vi) OTHER (SPECIFY)

9. (i) IMMUNIZATION (BEFORE INJURY)

YES _____ NO _____ NOT KNOWN _____

(ii) DAYS OF TREATMENT (BEFORE ADMISSION) _____

10. OUTCOME OF TREATMENT (DISCHARGE/DEATH)

11. CAUSE OF DEATH (SPECIFY)

12. POST MORTEM

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