DISCUSSION
Tetanus is still a formidable problem in our country and carries a high mortality. The treatment of tetanus has been mainly symptomatic. An expanding list of drugs used to achieve symptomatic control, only show that none of the drugs evolved so far satisfies the criteria of an ideal drug. Tetanus is almost unique among the bacterial diseases in having so far defied all therapeutic agents directed against it (Vaishnava et al., 1966). Although human antitetanus immunoglobulin (T.I.G.) has been available in the recent years, its role is yet to be determined and the method of administration and dosage has yet to be standardized.

In the present study from January 1988 to December 1988, tetanus cases comprised of 1.21% of total hospital admissions. Most of the patients were from Jhansi district of Bundelkhand region, followed by Shivpuri, Tikamgarh, Jalaun, Hamirpur, Datia, Lalitpur, Gwalior and Bhind districts of the Bundelkhand region. Illiteracy, poverty, lack of immunisation and poor medical facilities in the periphery, unhygienic customs and delivery practices are all rampant in this region although Bundelkhand has a rich historical and cultural background. This is one of the reasons for such a high
incidence of tetanus in the aforesaid areas. It is also possible that the soil in these regions especially in Jhansi region is more enriched with Clostridium tetani.

As regards tetanus cases in relation to total hospital admissions, Laha and Vaishya (1963) reported 4.8% cases due to tetanus. In the present study tetanus cases were 1.21% of total hospital admissions. Tetanus deaths in the present study accounted for 8.67% of total hospital deaths. Vaishnava et al (1966) reported 16% of total hospital deaths due to tetanus.

The comparative figures of the year 1983 and 1988 show an increased incidence and decreased mortality of tetanus in 1988 (Overall mortality was 68.53% in 1983 as compared to 51.42% in 1988) Better survival in 1988 may be attributed to the use of intrathecal T.I. C. in 1988 (as compared to A.T.S. only in 1983).

Most tetanus deaths occurred within the first week of admission, the maximum deaths occurring on the 1st and 2nd days following admission. Vaishnava et al (1966) noted somewhat similar observations. Though the patients started to improve from the 2nd day onwards maximum care occurred between 6th and 9th days. After that it remained constant till the seventeenth day.
Overall tetanus mortality in the present study was 51.42%. Adults had a higher incidence of tetanus among all groups (34.69% of total cases). The maximum mortality was found in tetanus neonatorum cases (82.92%). Lowest mortality was observed in the children (28.20%). Patel (1965) reported a mortality of 86.5% in tetanus neonatorum. Phatak et al (1973), reported 87.80% mortality in neonatal tetanus. Athavale et al also found a high mortality in neonatal tetanus. Sehgal et al reported an overall mortality of 86.2% in neonates, Childhood tetanus constituted 31.84% of total cases. Athavale et al, reported in their series an incidence of 39% of total cases due to childhood tetanus.

There was also, a high overall incidence of tetanus neonatorum (33.47%) in our present study. Bhat et al reported an overall incidence of 14.3% of tetanus neonatorum. Suri (1966), reported 26.8% overall incidence of tetanus neonatorum.

As adults were more prone to injuries and infections (they more active physically) there was a slightly higher incidence of tetanus in this group. Also, women in this age group, contributed to the child bearing age and were thus susceptible to puerperal tetanus. Domiciliary deliveries by untrained midwives (dais) and
the use of unsterile materials for cord cutting and
cressing (mustard oil, ash, etc.), all performed under
unhygienic conditions, made the neonates very suscep-
tible to tetanus. Bollet and Punjabi (1964) observed
100% home deliveries in neonatal tetanus.

The high mortality in the neonates can be
explained by the reason, that on entry of the Clostridium
tetani spores, in the infants umbilical cord, the
exotoxins subsequently released are quantitatively the
same as in adults (Khanna S.S. et al).

Childhood tetanus contributed to the least
overall tetanus mortality, which proves that children
could withstand the disease better. La force (1965)
pointed high case fatality rates in tetanus in the
extremes of age group.

The overall male/female ratio was 2.27:1 in the
present series. This ratio was the highest in neonates
(M:F :: 5.3:1). Mortality ratio of male:female was overall
1.06:1. It can be thus seen that the incidence was higher
in males whereas tetanus mortality was nearly the same
in both sexes. Mathur (1980) reported a male/female ratio
of 5.4:1, in tetanus. Kacharevic suggested that males
were more sensitive to tetanus toxin as compared to
females and hence a higher male preponderance. Suri et al,
found that tetanus mortality in the two sexes did not
differ much.
In the present study most of the cases of tetanus were from rural areas (91.42% of all cases). Patients drawn from rural areas were mostly labourer/farmers (i.e. they were engaged more in manual work and were more exposed to Clostridium tetani infection from soil etc. while handling). Thus a higher incidence was observed in patients from rural areas. On the other hand, because of lack of proper medical care and facilities in rural areas, such patients rushed to our hospital as soon as symptoms appeared and treatment could be started earlier (hence a lower mortality of rural tetanus patients 50%). On the contrary urban patients tried household remedies and took the help of local quacks, before they came to the hospital, though the access to the later was easier for them; consequently there was a higher mortality (66.06%) in them.

A higher incidence of tetanus neonatorum was found between June and November, although it was most prevalent during the monsoon season, in our present study. An increased birth rate during this season may be the possible reason for this (Guha, Mazumdar and Chakrabarty, 1974).

Bhat et al (1979) noted a higher incidence of tetanus neonatorum between June and October. Vaishnava et al, also noted a higher incidence during the monsoon
period. In the present study the peak incidence of childhood tetanus was found in March and April months. The possible explanation to this, is that children mostly stayed outdoors during this period.

The incidence of tetanus was the highest in the low socio-economic group of patients (66.98%) and the lowest in the high socio-economic group of patients (2.86%). The highest mortality was noted in the low socio-economic group of patients (59.76%) and the lowest in the high income group (28.59%). Higher incidence and mortality in the low socio-economic group patients can be attributed to the reason, that such patients on account of poverty & illiteracy were more nutritionally deprived, had a lower immunity, were more exposed to manual labour and more used to unhygienic customs and practices.

Rural children/students, labourer/farmers were all, more exposed to trauma and subsequent infections and therefore had a higher incidence of tetanus. Mortality was also high in such patients. However the highest mortality was observed in a cobbler, shepherd and a potter. It can be observed that all were manual labourers. In the cobbler the infection source was probably from handling footwear (leather material) besides handling old contaminated footwear for repair purposes.
Shepherds have a closer contact with sheep and cattle. Moreover they usually walk barefooted while rearing cattle. It would be expected that they are more prone to tetanus under such conditions.

Potters are engaged in handling clay with hands. Minor abrasions on the hand lead to ideal situations for Clostridial proliferation.

Post partum and post abortal tetanus had a high mortality (50%). Post-partum uterus provides a good anaerobic environment for Clostridial proliferation and this could be the possible explanation for puerperal tetanus. Shah et al (1962) found 59% mortality in post-partum tetanus.

Trauma was the most common etiological factor (20.41%). Otopenic infection was the next common etiological factor (9.79%), especially so in children, besides trauma. In an equally large number of cases (17.14%) no obvious cause could be found. Wesley et al, noted that tetanus was more common in bare-footed children who had no obvious injury.

Lock jaw, neck rigidity and dysphagia were the most common early complaints in all patients. In neonates it was excessive crying and inability to suck. Convulsions
appeared sooner in neonates. Most deaths in tetanus neonatorum cases occurred between 4 to 11 days of age at admission. Lesser was the age of the neonate at admission, the more was the mortality. Maximum recoveries in tetanus neonatorum cases occurred between the ages of 11 and 15 days on admission. Sokal et al, pointed that most deaths in neonatal tetanus patients, occurred at 4 to 14 days on admission. Phatak et al, noted that no neonate of or below the age of 7 days, on admission survived. He also observed that maximum number of neonates survived at an average age of 10.5 days on admission.

It was observed in the present study that shorter the duration of symptoms were, before admission the higher was the mortality. The mortality was the highest (73.33\%) when the duration of symptoms on admission was approximately 1 day. Phatak et al, noted that the disease pursued a milder course in neonates, who came to the hospital late after the onset of the disease. Athavale et al, observed that prognosis was worse in patients with a shorter duration of symptoms on admission, in children and neonates.

In the present series, it was observed that mortality increased with increasing grades of severity of tetanus on admission. This was in accordance with the Patel &
Joag's system of grading tetanus severity. Athavale et al, Jolly et al, also found similar observations. It was observed that mortality increased with a shorter incubation period, whereas a longer incubation period was associated with a better prognosis. (When incubation period was less than 7 days mortality was 70.43% and when more than 21 days it was 12.5%). Jolly et al, Vaishnava et al, have all noted that prognosis varies directly with the incubation period.

Where the period of onset was absent, the mortality in such patients was the lowest (8.33%). Mortality was the highest when the period of onset was less than 24 hours (76.47%). A shorter period of onset was associated with a worse prognosis. Cole, first reported that period of onset modified the outcome of the disease. Athavale et al, Bhat et al, Phatak et al, have all noted similar observations.

Mortality due to tetanus increased with temperature on admission (or within 24 hours of admission). With temperatures below 99°F it was 61.24% and with temperatures beyond 100°F the mortality was 77.55%. Spaeth et al, Vaishnava et al, Athavale et al, have all reported fever as a bad prognostic factor.
It was also found that prognosis was directly related to the severity of risus on admission. Mortality in patients with mild risus was 16.36%. It shot up to 75.97% in patients with severe risus. Risus was one of the last symptoms to disappear. Athavale et al, also noted similar observations.

Mortality was found to increase with increasing severity of neck rigidity on admission. Also, it was one of the last symptoms to disappear. Vaishnava et al, found that mortality increased with increasing severity of rigidity.

In the present study it was observed that increasing severity of dysphagia was associated with a worse prognosis. Mortality was 7.27% in tetanus patients with mild dysphagia. It increased to 86.60% in patients with severe dysphagia. Athavale et al, noted in children that mortality increased from 9.1% in cases with mild dysphagia to 100% in cases with very severe dysphagia. In neonates also he observed that mortality increased with severe grades of dysphagia. Phatak et al, have suggested that lock jaw and dysphagia increase the risk of aspiration pneumonia and consequently increased mortality.
It was observed that mortality increased with increasing severity of lock jaw in tetanus patients (mortality in mild lock jaw cases was 14.03% and 65.71% in severe cases). Athavale et al. also found an increase in mortality with increase in severity of lock jaw. Vaishnava et al. Bhandari et al. have also noted similar observations.

Spasms (convulsions) were one of the most important factors with regards to prognosis. It was found that mortality increased from 13.33% in patients with mild spasms to 30.99% in patients with severe spasms. Mortality thus increased with increase in the severity of spasms. Vaishnava et al. Bhat et al. Bhandari et al. all noted a similar finding.

Therapy

Fortunately nowadays with the availability of human tetanus immunoglobulin, tetanus treatment has become safer as compared to, in the past and even in the present times with the use of A.T.S. (equine). The present trial was done to assess the efficacy and the results of intrathecal administration of human anti-tetanus immunoglobulin (T.I.G.).

It was observed that overall mortality increased from 45.75% in patients receiving T.I.G. on the same day of admission to 100% in cases who received T.I.G.
on or after the IIIrd day of admission. This goes to prove that in order to be effective, T.I.G. should be given as early as possible on admission. Keswani et al, noted that with intrathecal administration of A.T.S. there was a mortality of 21.05% when the delay in administration of A.T.S. was upto 24 hours. Mortality increased substantially with further delay over 48 hours. Sanders et al, postulated that free toxin is available for neutralisation by intrathecal administration of tetanus antitoxin which circumvents the blood brain barrier. But probably after 48 hours, when the toxin is presumed to be fixed to the nervous tissue, intrathecal tetanus antitoxin is not of much value.

It was observed that intrathecal T.I.G. was more effective in all grades of severity of tetanus as compared to intramuscular T.I.G. In grade II patients mortality with intrathecal T.I.G. was 5.26% as compared to 100% mortality with intramuscular T.I.G. Similarly in grade IV cases mortality with intrathecal T.I.G. was 47.69% as compared to 75% mortality with intramuscular T.I.G., in the same grade. It was seen that intrathecal T.I.G. was more useful in milder cases of tetanus. Gupta R.S. et al (1980), also found similar observations with intrathecal T.I.G. In his series tetanus mortality was reduced to
3.0% with intrathecal T.I.G., from 7.5% with intramuscular T.I.G., in patients with mild tetanus, when administered early in the disease. Intrathecal T.I.G. was better in all grades of severity of tetanus, although its efficacy decreased with increasing severity of tetanus, in our series.

With the use of intrathecal T.I.G. in 72 adults, 70 children and 72 neonates, mortality was 37.5%, 25.7% and 72.2% respectively, as compared to a mortality of 67.5%, 75.0% and 100.0% respectively on using intramuscular T.I.G. in the same groups. Thus intrathecal T.I.G. was most effective in children.

Higher doses of T.I.G. were more effective in lowering tetanus mortality. The mortality was 66.66% with a dose of 250 I.U. of T.I.G., 47.12% with a dose of 500 I.U., 30.46% with a dose of 1000 I.U. and zero with doses of 1500 I.U. to 3500 I.U. Unfortunately only 7 patients could afford doses of 1500 I.U. and above owing to the high costs of T.I.G. However, it can be safely concluded that a minimum of 500 I.U. to 1000 I.U. of T.I.G. is essential by intrathecal route for tetanus therapy. It would be ideal if doses above 1500 I.U. could be given intrathecally. Chopra et al (1986) also found a beneficial effect of intrathecal T.I.G. in high doses in
moderate and severe cases of tetanus. On the contrary, Vakil et al. (1977), Chugh et al. (1955), found no beneficial effect of T.I.G.

Intramuscular T.I.G. was only administered in such patients where intrathecal procedure failed.

Better results of intrathecal T.I.G. are probably because of the direct action of T.I.G. on the unfixed circulating toxins in the central nervous system in C.S.F., by their neutralisation.

Intrathecal administration of T.I.G. needs to performed with care, owing to the risk of tonsillar herniation, as C.S.F. tension is increased in tetanus. However, no complications were noted due to intrathecal instillation of T.I.G., either because of the procedure or because of the drug itself. T.I.G. was found to be safe and free from any side effects. The intrathecal route was superior.

In the present study 3 patients expired due to renal complications. Venkat Raman et al. also have reported renal failure in tetanus.

Pulmonary complications including acute secondary lung infections was the most commonly assumed complication. Unfortunately no attendant submitted his patient for
autopsy. So the exact morbid pathology of cause/complications leading to death could not be determined. Most patients at the time of death suffered from severe respiratory spasms with apnoic spells. Tracheostomy was performed in 5 patients but none survived.

The incidence of tetanus in Bundelkhand continues to be high, owing to the fact that even after so many years of independence this region continues to be socio-economically backward. Consequently illiteracy and poverty are rampant, as is the lack of medical care infrastructure. Proper health planning and management are essential in order to provide adequate protection from tetanus and so many other diseases. Immunization and maternal and child health services need greater attention, along with provisions for adequate medical care and education, so that the disease may be arrested early and be possibly eradicated by universal immunization.