Present situation of cystic echinococcosis in Central Asia

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Abstract

Cystic echinococcosis (CE) caused by Echinococcus granulosus has always been an endemic disease in central Asia. During the period of Soviet Administration up to 1991, human surgical incidence rates tended to be relatively low with perhaps at most 1–5 cases per 100,000 per year. Following the collapse of the Soviet Union and the emergence of the New Independent States there has been profound economic and social changes. Associated with this has been a serious epidemic of CE throughout the region. In many areas figures suggest the surgical incidence is now greater than 10 cases per 100,000. Furthermore, official government figures are believed to substantially under report the extent of the problem. For example, official figures in Uzbekistan reported 819 cases of CE surgically treated in 2001. However, a detailed analysis of hospital records suggests that the true figure was 4089, more than 4 fold higher. The latter figure represents an annual surgical incidence rate of nearly 25 cases/100,000 per year. Similarly high endemic areas are seen in southern Kazakhstan, Kyrgystan and Tadjikistan with incidence rates of up to 13 cases/100,000, 20 cases/100,000 and 27 cases/100,000 respectively. A disproportionate number of cases are in children and the unemployed. The rates of infection have also increased in major livestock species such as sheep with a doubling of reported prevalence in some areas. In the dog population, independent studies in Uzbekistan and Kazakhstan have demonstrated that the rural dog population, closely associated with the sheep industry, is highly infected, with prevalences approaching 25%. Village and urban dogs have a considerably lower prevalence.

Keywords: Echinococcus granulosus; Central Asia; Epidemiology; Distribution

1. Introduction

Cystic echinococcosis is a re-emerging disease in the former Soviet Republics of central Asia [1]. The five republics of Kazakhstan, Uzbekistan, Kyrgyzstan, Tadjikistan and Turkmenistan have all undergone profound economic and social changes since the collapse of the USSR in 1991. This has included a substantial restructuring of the livestock industry. Large mechanised slaughterhouses are no longer economically viable and have been largely closed. Veterinary supervision of slaughter has been undermined by the closure of these large slaughterhouses and the lack of government finance to pay the salaries of veterinarians. The results of all these changes are that farms are usually relatively small and there has been an increase in unsupervised home slaughtering or slaughtering at markets with no veterinary inspection. In addition the dog population has increased in both rural and urban areas. The former due to the smaller livestock units whilst the latter due to increases in pets and security dogs. The unregulated slaughtering of animals, inadequate veterinary control of slaughtering and lack of veterinary public health has resulted in the increase in transmission of echinococcosis throughout the region. In all 5 countries there has been a substantial and sustained increase in recorded human cystic echinococcosis with an increase of 4 or 5 fold in some areas. In the livestock rearing areas of southern and western Kazakhstan and throughout the other 4 republics there are now high incidences of human echinococcosis with the general incidence rate of above 3 cases/100,000.
per year and in some districts the incidence is higher than 25 cases/100,000 per year (Fig. 1). There has also been a parallel increase in cystic echinococcosis in farm livestock and increases in the prevalence of infection in the dog population.

2. Human cystic Echinococcosis

2.1. Kazakhstan

Human cystic echinococcosis is found in all areas of Kazakhstan, but the regions with the highest human incidence rate are in the south of the country where the greatest numbers of sheep are kept. There has been a dramatic increase in the numbers of surgical cases of human cystic echinococcosis recorded in the last 10 years. Between 1974 and 1994, there were between 0.9 and 1.4 cases per 100,000 people recorded but between 1994 and 2003 the surgical incidence increased from 1.4 to 6.4 cases per 100,000. This is approximately 4.5 times higher than previously recorded. The absolute number of cases has increased from 202 cases in 1995 to 970 cases in 2003 (Fig. 2). The increase in the infection rate has been recorded throughout Kazakhstan but the highest human incidence rates are seen in Almaty, Zhambul, South Kazakhstan and West Kazakhstan Oblasts [4,5]. Nevertheless, there are increases in cases even in oblasts that are not highly endemic for the parasite. Of particular concern is the data in children. Between 1993 and 2000 the proportion of cases in children under 14 years of age has risen from 19.9% to 32.2% across the whole country. A detailed study of hospital records in Almaty [5] demonstrated that there were 1405 cases recorded in

![Graph showing change in numbers of surgical cases recorded in Kazakhstan between 1994 and 2003.](image-url)
Almaty hospitals between 1990 and 2003. Of these cases 96 (7.8%) were in children of up to 6 years of age and a further 289 cases (23.4%) were in children between 7 and 16 years of age. In adults 53.4% were female and 46.6% male whilst in children the proportions were 46% and 54% respectively.

2.2. Uzbekistan

Official figures suggest that the number of surgical cases of echinococcosis reported in 1988 was 387 [3]. By 1998 this had increased to 1438 (5.8 cases per 100,000) or 3.7 times higher. The official case numbers appear to have levelled off or started to decline with 1435 cases reported in 2000 and 819 cases reported in 2001 [6]. However, official figures are a substantial underestimate. Nazirov and others [6] undertook a detailed study of hospital records throughout Uzbekistan and found a total of 4430 cases in 2000 and 4089 cases in 2001 (17.8 and 16.5 cases per 100,000 respectively). Even higher case numbers have been suggested from a serological study [3]. Seropositivity for the whole population of Uzbekistan was calculated at 0.7% with an estimated 167,300 individuals seropositive. From this number of seropositives it was suggested that the true case numbers are approximately 12,520 or nearly 3 times higher than the numbers reported from hospital records by Nazirov and others [6]. These discrepancies could be resolved as the extrapolation from serological results is more likely to be representative of current prevalence with many cases not presenting for treatment for a number of years if at all. The lower numbers reported from the hospital records will be a more accurate reflection of true case incidence. In addition, the serological test used by Abdiev and others [3] was not described, making critical evaluation of the data difficult.

Analysis of the hospital data [6] shows that echinococcosis is frequently distributed amongst children and young adults. In 2000, 14.3% of cases were in children less than 14 years of age. Of the 85.7% adults, 54% were women and 46% men. In 2001, proportion of paediatric cases had risen to 20.4% whilst of the adult cases 50.9% were women and 49.2% men. Between 20% and 30% of cases had recurrences after surgery, whilst surgical case mortality rates were between 2% and 5%.

Boymuratov (The surgical treatment of hepatic echinococcosis in children—clinical and experimental studies. Abstract of the Dissertation for the Master of Medical Sciences, Tashkent; 1996.) analysed 86 paediatric case histories from the children’s surgical hospital in Samarkand. Of these cases 27.9% were in children less than 7 years of age, 25.6% in children of 8–10 years and 46.5% in children 11–15 years of age. The overall regional incidence rates for human echinococcosis are highly variable, with very high levels (>10 cases/100,000 official, 29.4 cases/100,000, from hospital records) recorded in Bukara, Sirdarin, Fergan and Khoezm Oblasts with much lower incidences recorded in Tashkent (Fig. 1) [6].

2.3. Tadjikistan

According to the data of the National Medical Statistics Centre SES [2], the numbers of human cases of echinococcosis in Tadjikistan have increased from 374 cases in 1992 to 1875 cases in 2002. The growth in the numbers of cases is associated with the economic and sanitary conditions that occur concurrently with social and political instability. The area with the greatest number of cases is the northern part of Tadjikistan. This includes the city of Xudzhand and the regions of Asht, Ainin, Ganhin, Zafarabad, Isfarin, Kanibadam, Dedzhiken and Nau. In that zone the annual incidence rate is probably as high as 25 cases per 100,000 or more (Fig. 2). The remaining areas have a somewhat lower incidence, but are still likely to exceed 10 cases per 100,000. These figures are estimated from the overall case numbers reported in 2002 by the medical statistics centre and the relative incidence levels, in the regions, which were officially reported as lower than the incidence for the whole country. The anomalies between local data and the national figures may be associated with the unstable political situation in some regions. It is also likely that significant numbers of cases are hospitalised in small regional hospitals rather than large city hospitals and these are less efficient at reporting the numbers of cases treated. Therefore the numbers of cases could be even higher than official figures suggest.

A small study of cases presented at the casualty department at the GKB hospital in Dushanbe recorded 235 cases of

![Fig. 3. Changes in the absolute number of human surgical cases (■) and the case incidence (-) between 1991 and 2002 recorded in Kyrgyzstan (data from [7]).](image-url)
echinococcosis between 1997 and 2001. On average, echinococcosis accounted for 2.4% of surgical admissions. Cases consisted of 39.7% male and 60.3% female. The analysis of the age of recorded cases demonstrates that children up to 14 years of age account for 7.8% of cases; on average 58.7% of cases are in people between 18 and 48 years.

2.4. Kyrgyzstan

Kyrgyzstan is intensely endemic for *Echinococcus granulosus*. In addition, the annual human surgical incidence has increased dramatically in recent years, rising from about 5 cases per 100,000 to nearly 20 cases per 100,000 between 1991 and 2002 (Fig. 3) [7]. A high proportion of these are in young children. Over 30% of cases are recorded in individuals of 14 years of age or less. This very high number of paediatric cases indicates active transmission.

An ultrasound survey demonstrated that perhaps greater than 1% of the rural population may be infected with echinococcosis [8]. Water supply may be an important factor in transmission as those with a clean water supply such as wells had a significantly lower prevalence rate than other sources. Amongst patients presenting for treatment in hospitals, there is a disproportionately high numbers of unemployed. At the present time it is not known if the unemployed are more susceptible because of perhaps an increase in poverty, or unemployment is the result of a deterioration of health as a result of the disease. If it is the latter it demonstrates the potential high burden of disease inflicted by this parasite.

2.5. Turkmenistan

During the period 1978–2000 medical and surgical records from hospitals in Turkmenistan were reviewed. A total of 3671 records of patients operated for echinococcosis were identified. Achal County had the highest numbers of cases (43%) with 22% in Mary County and 18.1% in Lebap County. Low numbers of cases were found in the two northern counties: 9.5% in Balkan County and 7.5% in Daskovuz County. The overall incidence in the country has increased—17 cases per 100,000 recorded in 2000 which is a 3 fold increase since 1988. The estimated regional incidence varies between approximately 30 cases per 100,000 in Achal County to 6.2 cases per 100,000 in Daskovuz. There appears to be similar numbers of men and women infected. However, 32% of the cases are in school children.

3. Echinococcosis in animals

3.1. Kazakhstan

Infection of dogs is widespread. A comprehensive purgation study of approximately 2000 dogs was undertaken between 1999 and 2002 [9]. Farm dogs, which are associated with livestock husbandry, were shown to have a prevalence of 23% while village dogs have a general prevalence of approximately 6%. Likewise, the intensity of infection is much higher in farm dogs, with a mean abundance in farm dogs of 631 parasites per dog, and only 27 parasites per dog in village dogs. Further studies [10] have demonstrated that this appears to be a consistent pattern of infection in rural dogs. Hospital records suggest that a disproportionate number of cases of human echinococcosis are in livestock farmers or in unemployed individuals who were previously livestock farmers [5]. This is consistent with the farm dogs, with their much higher prevalence and abundance of infection playing the key role in the transmission of this parasite. To date, of over 1000 dogs investigated in the city of Almaty, only one has been shown to be infected with *Echinococcus* (unpublished). This suggests transmission to urban dogs is at a much lower rate than rural dogs.

Between 1999 and 2000 sheep from Almaty, Zhambul and South Kazakhstan Oblast were examined for cysts of *E. granulosus* [11]. Cysts were seen in all age groups of sheep, but mean numbers of cysts per animal increased with age. Analysis of the data suggested that the infection pressure of 1.98 cysts per year was higher in the Almaty region than in Zhambul or South Kazakhstan where the infection pressure was about 1.2 cysts per year. Likewise, there was an increase in prevalence with age. Thus, in lambs of 1 year of age, the prevalence was approximately 25% and 20% in these respective regions, and rising to 57% and 49% in 3-year-old animals, and over 80% and 74% in animals 6 years or over.

3.2. Uzbekistan

Paralleling the rise in the incidence of human echinococcosis has been an increase in the prevalence of echinococcosis in animals. Between 1990 and 2002, the prevalence rate in sheep has increased from 45% to 62% whilst in cattle it has increased from 24% to 45% [12]. Data of the prevalence in agricultural animals is presented in Table 1.

Recently a study of the prevalence in dogs was undertaken by purging 531 dogs with arecoline from 9 different townships [12]. A total of 240 village dogs and 279 farm dogs were investigated. The respective prevalences were found to be 7.9% in village dogs and 20.1% in farm dogs. The farm dogs were significantly more heavily infected than village dogs overall, which is consistent with findings from a similar study in Kazakhstan [9]. In Uzbekistan there are estimated to be approximately 1.5 million dogs with 75% of households

3.3. Prevalence in domestic livestock between 1990 and 2002 in Uzbekistan (data from [12])

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<tbody>
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<td>26.2</td>
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<td>38.2</td>
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<tr>
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<td>54.5</td>
<td>57.0</td>
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<td>9.5</td>
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<td>Pigs</td>
<td>6.0</td>
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<tr>
<td>Camels</td>
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owning dogs [3]. Therefore with 1 dog for every 15 people this high prevalence represents a considerable biomass of parasite and hence risk of human infection.

3.3. Tadjikistan

A total of 18,256 animals were examined during the last 10 years (1991–2001) in Dushanbe and Kurgantiobi slaughterhouses, the veterinary laboratory of the veterinary sanitary inspectorate, and the markets for collective farms. These included 8144 small ruminants, 6679 cattle, 1601 pigs and 94 horses [2]. Sheep were the animals that were most intensely infected with *Echinococcus*. Of the total number of sheep investigated, 20.5% were infected with *Echinococcus*. Only 6.1% of young animals were infected, whilst the prevalence in goats was 17.6%.

The analysis of the veterinary statistics demonstrates that the prevalence of ovine echinococcosis in Tadjikistan varies regionally. The region with the lowest prevalence is central Tadjikistan. In this region 401 small ruminants were infected from a total of 3400 examined (11.8%).

In farms from southern Tadjikistan the prevalence in small ruminants is 31.8%. In adult animals it is 36.2% whilst in young animals it is 7.8% and in goats 25.2%. The intensity of infection ranges from 1 to 10 cysts in each organ infected. The areas with the highest prevalence have 41.8% of small ruminants infected, with 2–18 cysts in each infected animal. The numbers of cysts increases with age, with higher numbers found in the liver than the lungs. In old sheep the prevalence of infection approaches 80%.

On the basis of the data there are 4 distinct zones which vary according to the prevalence of *Echinococcus* in sheep [2]. Zone 1: most intense endemic area of northern Tadjikistan where the prevalence of infection is over 50%. Zone 2: high endemic districts of southern Tadjikistan where the average prevalence in adult sheep is 21.4%. Zone 3: endemic regions of central Tadjikistan where the prevalence is less than 20.7%. Zone 4: areas of low endemicity, which are mainly in districts close to the Chinese border, where the prevalence in sheep is 7.0%.

Echinococcosis is found in cattle in all regions of the country [2]. From investigations from 48 districts, between 30% and 62.5% of farms reported the presence of *Echinococcus*. Necropsy of 6679 cattle from south and central Tadjikistan demonstrated that 214 were infected with *Echinococcus*, which gives an average prevalence of 3.2%. In cattle older than 5 years the prevalence was 8%; in young animals it was just 2%.

In districts in central Tadjikistan the average prevalence in cattle was 2.5%, with adults recording 5.9% prevalence whilst young stock had a prevalence of 2.1%. In farms from southwest and eastern areas of southern Tadjikistan the average prevalence in cattle was recorded as 7.9%, with old cattle having a prevalence of 8.8% and young stock only 0.5%. The highest prevalence of *Echinococcus* are found at inter-district markets and feeding stations where contact with rural dogs is considerably higher than in industrial areas.

Pigs are not heavily infected with *Echinococcus*. *Echinococcus* was only found in farms of 4 out of 8 districts investigated [2]). Of 1601 animals examined in slaughterhouses and offal examined in 3 laboratories by the veterinary sanitary inspectors only 33 animals were found infected with *Echinococcus*. This gives an average infection rate of 2.1%, with just 1–4 cysts found in each infected animal.

*Echinococcus* was not found in any of 94 horses examined.

Carnivores play the most important epidemiological role in the transmission of *Echinococcus*. Murmínov and others [2] demonstrated that the prevalence in dogs is approximately 15.2% from a detailed examination of the intestines of 120 animals caught or shot in central Tadjikistan.

3.4. Kyrgyzstan

According to the veterinary statistical data, the average prevalence of echinococcosis in sheep in the last 7 years is 34.1% with the prevalence now as high as 55.6%. Old ewes have a prevalence of 81.2%. Rams have a prevalence of 11.4%, with young sheep less than 2 years of age having very few cysts [7]. In old sheep, 88.1% of cysts are fertile, in sheep of 3 years of age this is only 21.2%, whilst in very young sheep fertile cysts were not found. Particularly high levels are seen in animals in Kochkor, Dzamgal, and Dzeti-Oguzsk Rayons. This corresponds to the high human incidence in these areas. Over the long term there is a tendency for the prevalence in sheep to increase at an annual rate of approximately 3.5%. In cattle and pigs prevalences are lower at 5.2% and 1.8% respectively. To investigate the level of infection in dogs 1214 animals were necropsied from various areas [7]. The prevalence of infection has more than doubled between 1991 (4.8%) and 2001 (11.2%). The intensity of infection increased from 187 to 496 parasites in each animal. Dogs living close to villages or on the outskirts of cities had higher prevalences of 19.2% and 25% respectively.

3.5. Turkmenistan

Little information is presently available although animal infection rates appear to be very high: 51% in sheep, 38% camels, 11.9% cattle, 4.9% pigs [13].

4. Conclusions

This brief review gives an overview of cystic echinococcosis in central Asia from recent published work. A distinct pattern has emerged with high human surgical incidence rates with some districts the incidence rate reaching 30 cases per 100,000 per year. Northwestern and southern Kazakhstan and most districts of the other 4 central Asian republics are affected. Human incidence rates have increased markedly since the collapse of the Soviet Union and there are high infection rates in sheep and rural dogs. Mature sheep generally have a prevalence of 50% or more, whilst 5–30% of rural dogs are infected. Higher prevalence rates are seen in farm dogs associated with the sheep industry, while lower rates are seen in other rural dogs.
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References