

## The epidemic characteristics of Kaschin-Beck disease (KBD) in different eco-environments

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**Abstract**— Epidemiological survey of 573 families, clinical examination of 2593 persons, and X-ray examination of 1136 persons (in 16 typical endemic villages) were conducted, based on the classification of endemiology for KBD disease areas, i.e., mountain type, loess plateau type, plateau type, and flatlands type. It was revealed that the KBD disease areas exhibited the regular pattern of coming-into-being, development and passing-away and the characteristics of growth and decline. Further, it was found clinically that the disease areas may be divided into 4 types, i.e., recent onset, developing, stable, and historical. This division is simple and easy, practical, scientific, and reliable and can be applied by medical personnel at different levels.

**Keywords:** Kaschin-Beck disease; eco-environment; incidence.

### INTRODUCTION

KBD is an endemic, deforming osteoarthropathy closely related to eco-environment. The etiology and regular pattern of onset are still unclear. Based on the ecological and environmental characteristics of the disease areas, they could be classified endemiologically into 4 types, i.e., mountain, plateau, loess plateau, and flatlands. There is still no report so far on the regular patterns and the evolution of patient's conditions in KBD disease areas of different types. It is of primary significance to probe into this question prior to study of etiology and prevention and so on. In this paper, the epidemiologic results are reported of 16 endemic villages and a "health island" in a typical disease area.

### METHODS OF SURVEY

#### *Subjects*

All the permanent inhabitants were asked for family epidemiologic survey and the population over 5 years of age were subjected to a clinical examination.

#### *X-ray examination*

Orthophoric X-ray film of right hand was taken for children of 5-15 years of age and those with unsettled clinical diagnosis.

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The clinical diagnosis and clinical determination of disease area type were settled by related criteria of KBD in Jilin Province.

The X-ray diagnosis and X-ray type, activity index and severity index of disease areas were determined according to the related national criteria for judgement.

## RESULTS AND ANALYSES

### *Distribution of different types of endemic villages in this survey*

#### Disease areas of mountain type

Buluo Village in Suling County, Senlinshishanli Village in Shangzhi County, Heilongjiang Province; Hedong Village in Fusong County, Jilin Province; Hezhuang Village and Diaozhuang Village in Qingzhou City, Shandong Province. The 3 villages in northeast China have been surveyed only for 50–60 years with severe state of illness in the early years and alleviation in recent years. The 2 villages in Shandong Province has had already a history of over 140 years.

#### Disease areas of plateau type

Kehe Village in Aba County, Sichuan Province. This is a plateau-Tibetan village in Aba, settled for 30 years, part farm and part herd, with KBD in the adults and alleviation of disease state in recent years.

#### Disease areas of loess plateau type

Shuiqing Village, Tielu Village, and Mashan Village in Qingshui County, Mujiaoshan Village, Gaojiayao Village, Renjiabao Village, Peijiawan Village, Wujiawan Village, Wangxiao Zhuang Village and Hejiawan Village, and Liujiahe Village which is a non-endemic village near the last 4 foregoing villages, in Qincheng Prefecture, Gansu Province.

### *The results from survey on clinical state of illness*

In the 16 endemic villages and 1 non-endemic village in the 4 provinces and 1 prefecture, the surveys were conducted in 573 families from which 2593 persons were subjected to a clinical examination and 1136 subjects had their X-ray films taken. Based on the results from the surveys, and by taking into account the difference between various age groups, the rate of clinical detection, and the existence of patients, there were 3 conditions present as follows:

1. With KBD patients in the locality appeared only in the age group of over 30 years old, there were altogether 2 villages, accounting for 12.5% of the total number of villages surveyed. The detection rate in every age group is shown in Table 1.

2. With KBD patients appeared in every age group while the younger age group having a lower detection rate than the elder age group in general, i.e., there being a tendency of the detection rate increasing as the age becoming elder, there were altogether 4 villages, accounting for 25.0% of the total number of villages surveyed (Table 2).

3. With KBD patients appeared in every age group while the younger age group having a markedly or slightly higher detection rate than the elder age group and either of the

groups having a quite high total detection rate, there were altogether 7 villages, accounting for 43.8% of the total number of villages surveyed (Table 3).

Table 1 The clinical detection status in 2 historical endemic villages of KBD

	Age 0-----			15-----			20-----			30-----			Total		
	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %
Hezhuang	110	0	0.00	28	0	0.00	48	0	0.00	149	17	11.41	335	17	5.07
Diaozhuang	112	0	0.00	28	0	0.00	53	0	0.00	137	1	0.73	330	1	0.30
Liujiahe*	82	0	0.00	14	0	0.00	11	0	0.00	70	0	0.00	177	0	0.00

\*"health island" among disease areas.

Table 2 The clinical detection status in 4 stable endemic villages of KBD

	Age 0-----			15-----			20-----			30-----			Total		
	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %	No. of person exam.	No. of person detec- ted	Det- ect- ion rate, %
Buluo	116	7	6.03	14	1	7.14	4	0	0.00	27	2	7.41	161	10	6.21
Tiedi	88	17	19.32	35	11	31.43	59	26	44.07	146	42	28.77	328	96	29.27
Mashan	43	11	25.58	8	0	0.00	13	5	38.46	42	17	40.48	106	33	31.13
Renjiabao	125	14	11.20	30	11	33.33	38	7	18.42	96	10	10.42	289	41	14.19

### The results from X-ray examination

According to the detection rate of children's X-ray hand film and the changes in metaphysis and epiphysis, the activity index and severity index of the patients' conditions were separately calculated to indicate the state of disease and severity. Then using the fixed percentage of the X-ray detection rate and metaphysis positive rate as the criteria for judgement, the KBD disease areas were divided into active severe disease area (indicated by \*\*\*\*), relatively active severe disease area (\*\*\*), relatively stable, mild disease area (\*\*), and stable, mild disease area (\*) (4 disease areas of X-ray types). The results from this survey showed the following 3 conditions, according to the above division, with some in conflicts with the

2. The areas with only one of the above 2 items in compliance with the criteria for judgement cover 37.5% of the total number of villages surveyed (Table 5).

Table 5 The endemic villages with only one item corresponding to the criteria for judgement

	No. of person exam.	No. of person detected	Detection rate, %	Metaphysis positive rate, %	Activity index	Severity index
Serlin	103	29	28.16	16.30	32.32	59.18
Tielu	56	16	28.57	12.50	23.61	41.07
Mashan	32	11	34.38	21.88	50.45	34.38
Mujiaoshan	49	27	55.10	16.33	32.19	69.91
Peijiawan	31	26	83.87	45.16	66.90	118.85
hejiawan	39	36	92.31	43.59	110.26	103.42

3. The areas with both of the above 2 items without compliance with the criteria for judgement cover 2 villages, i.e., Hezhuang and Diaozhuang. Although no KBD patient was found in the age groups of 5–15 years old children, the primary KBD has been found being with the adults living in these 2 villages. Thus, the 2 villages should be identified as the disease areas (Table 6).

Table 6 The endemic villages with both 2 items not corresponding to the criteria for judgement

	No. of person exam.	No. of person detected	Detection rate, %	Metaphysis positive rate, %	Activity index	Severity index
Hezhuang	111	0	0.00	0.00	0	0
Diaozhuang	112	0	0.00	0.00	0	0
Liujiahe #	177	0	0.00	0.00	0	0

# "health island" among disease areas

## DISCUSSION

From northeast to southwest of China, 16 typical endemic villages of different ecological environment types were selected to carry out the epidemiological survey, clinical and X-ray examination. The states of evolution in these disease areas were discussed as follows:

The endemic villages in northeast of China have been exploited for only 50–60 years, and in general, KBD occurred with severe state of illness after 3–5 years of exploitation in the past, for example, in Hedong Village of Fusong County, Jilin Province. The detection

rate of KBD in 1950 was 92.7%. Since water sources were changed from earth well and river to deep wells in 1968, the state of illness has been gradually alleviated. The X-ray detection rate in children's body was found to be only 2.44%. During the same period the same events occurred in Buluo and Senlin Villages. The endemic village in Shandong Province were exploited earlier. Diaozhuang Village was built in 1847 with unknown medical history in the past. From the examination this time, there were only patients among population over 30 years of age. Considering the fact that the onset of KBD appears more commonly in the age group of 6–15 years old, it is inferred that the onset of disease has been controlled for more than 30 years. And also due to the fact that following an affected KBD there would be life-long signs left, it can be certain that there was no recent onset during this period, indicating no "rekindling" phenomenon in the disease area.

The endemic villages in Gansu Province had a history of a thousand years in general. In Shuiqing Village having a history of 1500 years, there were KBD patients among villages of an age over 70 years old, and as was told, there had been KBD patients among their ancestors. It is inferred that there was a KBD history at least 70–80 years in that village. And recent onsets were still uninterrupted till now, manifesting itself clinically as a developing endemic village. More typical state of illness also occurred in Pejiawan, Wujiawan and Hejiawan villages with high activity index, while the severity index being not necessarily content with the activity index. On the contrary, there were also villages with a state of illness at the initial stage of stable control, such as Mashan, and Renjiabao villages, manifesting themselves clinically as stable endemic villages with low activity index, also belonging to the stable mild endemic villages.

Besides, according to the survey in Xinfang Village and Runzi well of Qianan County, Jilin Province, in 1973 that endemic village was disease area of flatlands type without historical epidemics of KBD. But since Xinfang Village was built in 1960, the drinking water source has been changed in 1966, and KBD appeared to begin from 1969. In 1973 the X-ray detection rate among villagers with an age of 6–15 years old was 66.96%, and those of 16–20 years old, 36.59%, with no primary onset of disease among population of an age over 21 years old in the locality, manifesting itself as a new disease area. Since 1975 following a change in water sources to deep wells, a check in 1978 showed no new onset, and an improvement of the previous patients. Since then no new onset appeared. Such type of disease area showed a feature of "sudden" onset and rapid control.

From the above discussion it is clear that the KBD disease areas also exhibited the regular developing pattern of their coming into being, developing and passing away of things. Hence the authors classify the disease areas, based on disease state, into recent onset, developing, stable, and historical ones according to the history of the disease areas, features of disease in each age group, and the time of controlling the occurrence of new onset and so on. The first 2 types of disease areas are in the developing stage, indicating a strong pathogenic

factor, and the stress for studies of prevention and treatment. The latter 2 types are in the decaying stage of disease areas, indicating the weakening and elimination of the disease factor. The disease areas provided for summarizing experiences for prevention and treatment. This classification has the advantages of recognizing the disease areas as distinct, integral, continuous and corresponding to the regular developing pattern of things. Conflicts in classification are unlikely to occur, and is practical. Because it can be determined on the basis of the clinical results, it may be applied by clinic groups for KBD prevention and treatment without being handicapped by lack of equipments and economic conditions. Not only is it simple and easy, but also scientific and reliable.

With the X-ray detection rate and metaphysis positive rate in children's body as the two criteria and the fixed percentage of them, the degree of activity of the disease areas was determined. Only 50% of the areas surveyed corresponded to both criteria, and 37.5% of the areas corresponded to 1 item, those without correspondence to both 2 items, i.e., corresponded to none of them, and were not classified into any of the types and hence we have to deny them to be disease areas. The factors responsible for the changes in disease area will be discussed elsewhere.

## CONCLUSION

Through the epidemiologic survey of 573 families, clinical examination of 2593 persons, and X-ray examination of 1136 children in 16 typical endemic villages of KBD with 4 different ecological environments, an analysis of the results showed that KBD exhibited the regular pattern of coming into being and developing of things, and the rates of growth and decline for each stage of illness were different. Next we classify the disease areas, into 4 kinds of recent onset, developing, stable, and historical, according to medical history of the disease area, the age features of morbidity, and the duration of no new onset. There are many features in this kind of classification, i.e., simple and easy, highly scientific, and being able to provide a basis for the studies of prevention and treatment.

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