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Spondylolysis in Eskimo skeletons

Spondylolysis was found in 25 of 46 spines of Eskimos from Greenland, at L1 in one case, at L3 in five cases and at L4 and L5 in 14 cases each. Two spondylolytic vertebrae were seen in the same spine in nine cases. Among young individuals, spondylolysis was found in 2 out of 15 spines and in older in 23 out of 31. The prevalence of spondylolysis was higher, the fourth vertebra was more commonly affected, and spondylolysis occurred at an older age in Eskimos than in other ethnic groups.

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Spondylolysis of the lumbar spine has been reported to occur frequently in Eskimos. It occurred in 14–45 per cent of Eskimo skeletons from Alaska and Canada (Stewart 1931, Lester & Shapiro 1968, Gunnes-Hey 1980, Merbs 1983). In other populations spondylolysis has been reported in only about 5 per cent (Willis 1931, Yano et al. 1967, Eisenstein 1978).

About one third of all Eskimos live in Greenland, but there are no reports on the prevalence of spondylolysis in skeletons from that area. I have studied 46 Eskimo spines from Greenland.

Material and methods

The spines were from the large collection of Eskimo skeletons at the Laboratory of Anthropology, University of Copenhagen, Denmark. The skulls and the bones of the extremities in this collection have been described by Balslev Jørgensen (1953). Due to defects in many of the skeletons it was possible to reconstruct only 46 intact lumbal spines. The pelvic bones were included, except in one cases.

Of the 46 spines, 31 were found in graves at different locations in West Greenland, eighth were from the southern and seven from the northern part of East Greenland. The skeletons were several hundred years old, with the majority originating from the time before or shortly after the Danish colonization of West Greenland at the beginning of the 18th century. The skeletons are assumed to be pure Eskimo without any racial admixture (Balslev Jørgensen 1953).

Spondylolysis was recorded if the pars interarticularis of the neural arch showed a complete defect not caused by a lesion after death. The presence of spina bifida, lumbalization, sacralization and compression fractures was also registered. The spines were placed in three groups according to their estimated age.

Group 1: Seven adolescents with the crista apophysis not fully developed or incompletely fused (younger than 25 years of age).

Group 2: Eight young adults with fused apophysis but without osteophytosis of the vertebrae.

Group 3: Thirty-one mature adults with osteophytosis of the vertebrae ranging from slight to marked osteophytosis nearly bridging the intervertebral space.

Osteophytosis at the level of spondylolysis is often regarded as a result of the instability caused by the spondylolysis. Therefore, this kind of osteophytosis was not included in the assessment.

Determination of sex was based on the shape of the pelvis, developement of the paraglenoidal sulcus and the presence of symphysial pitting, which only occurs in adult females (Stewart 1957). In one case, where the pelvis was missing, the sex was determined as male, based on the shape and dimensions of the bones of the extremities.

The chi-square test was used to test differences among groups, and p-values below 0.05 were considered significant.

Results

The occurrence of spondylolysis was 23 out of 31 in spines with osteophytosis, compared with only 2 out of 15 in spines without ($p < 0.05$, Table 1).

Spondylolysis was found in one or more ver-

Table 1. Spondylolysis in 46 Eskimo skeletons

	Spines N	Spines with spondylolysis n	per cent *a*
Adolescent	7	1	*13 (2–41)*
Young adult	8	1	
Mature adult	31	23	*74 (56–88)*
Total	46	25	*54 (39–69)*

a 95 per cent confidence limits in parentheses.

tebrae in 13 of 21 males and in 12 of 25 females. The location of the spondylolysis was at L1 in one case, at L3 in five cases, and at L4 and L5 in 14 case each. Spondylolysis was found in two vertebrae in the same spine in nine cases. In six spines L4 and L5 were affected, and in three spines L3 and L4. In 19 of the 34 vertebrae with spondylolysis the separate arcus was missing.

In two vertebrae (once L1 and once L3) the defect was unilateral, and the arcus remained attached to the anterior part of the vertebrae. In another two cases a unilateral spondylolysis was combined with spina bifida, and in a further two cases a unilateral defect was combined with a defect in the lamina on the opposite side. Table 2 shows the total number of lumbar vertebrae, and the occurrence of spondylolysis in them.

In five cases there were narrow bifida defects in the first sacral vertebrae, and in two cases all sacral segments were bifid. In one of these there was sacralization of L5 and spondylolysis of L4 as well. Lumbalization was found in one spine, giving six lumbar vertebrae, and in two cases lumbalization was incomplete. Sacralization of L5 was found in two spines, making L4 the last free vertebrae. In both these cases there was spondylolysis of L4. Compression fractures were found at L1 in four spines. In one spine with spondylolysis of L4 and L5, the pars of L3 was heavy and irregular as in a healed fracture. Radiographs were obtained and they supported the diagnosis.

Discussion

This is the first report of spondylolysis in Eskimo skeletons from Greenland. It confirms similar studies from Alaska and Canada, showing a much higher occurrence of spondylolysis in Eskimos than in populations from USA (5 per cent), Japan (7 per cent), Israel (10.5 per cent) and South Africa (3.5 per cent) (Willis 1931, Yano et al. 1967, Magora & Schwartz 1980, Eisenstein 1978). The high incidence of spondylolysis in all studies of Eskimo spines suggests a genetic factor. In whites, spondylolysis usually appears in late childhood (Wiltse 1962, Fredrickson et al. 1984). In Eskimos, the natural history seems to be different. There is a marked rise in prevalence in middle age, when lumbar osteophytosis appears. Before the age of 30, osteophytosis is rare, but above the age of 50 it is a constant finding in Eskimo spines (Stewart 1953, Gunnes-Hey 1980).

Trauma and repetitive stress may play a role in the etiology of spondylolysis, and cases of spontaneous healing have been reported (Wiltse et al. 1975, Sherman et al. 1977, Jackson et al. 1981, Krenz & Troup 1973). The compression fracture frequency of one-tenth in this material does not indicate a history of severe

Table 2. Spondylolytic vertebrae according to age group and level

	Total no. of vertebrae	Vertebrae with spondylolysis						
		L_1	L_2	L_3	L_4	L_5	No.	*Per cent*
Adolescent	35	0	0	0	1	0	1	*3*
Young adult	40	0	0	0	0	1	1	*3*
Mature adult	154	1	0	5	13	13	32	*21*
Total	229	1	0	5	14	14	34	*15*

trauma to the back in the majority of Eskimos from Greenland, and in only one case was a healed spondylolysis suspected.

In non-Eskimos, the spondylolysis is located in the fifth lumbar vertebrae in about 90 per cent of cases (Fredrickson et al. 1984, Willis 1931). In Eskimos, spondylolysis of L4 is relatively more common. Stewart (1931) reported L4 affected in 28 per cent and L5 in 64 percent of the spines with spondylolysis in Alaskan Eskimos. In Canadian Eskimos, the corresponding figures are 34 per cent and 39 per cent (Merbs 1983). In spines from Greenland, spondylolysis was found as often in L4 as in L5.

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