H77 Lumbosacral Transitional Vertebrae, Spondylolysis and Spondylolisthesis: Prevalence in a Modern Forensic Skeletal Population

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Attendees will be introduced to the prevalence of the varying presentations of transitional vertebrae in clinical populations and a modern forensic sample. Implications for their usage as unique identifying features will be discussed.

Sacralization of the fifth lumbar vertebra (L5) (i.e., fusion to S1) is generally thought to be an abnormal morphological expression of the anatomical transition between the lumbar and sacral spine. Information in the clinical literature indicates that the majority of all cases of anomalous transitional vertebrae occurs low on the lumbar spine and typically involve the sacrum. The specific cause of sacralization is not well understood, but is usually considered to be of developmental, rather than activity-related, origin. The timing of this fusion has been noted as early as birth, but most instances seem to manifest during early childhood development. In adults, sacralization of L5 is often accompanied by degenerative spondylolisthesis (translation or movement) of L4 relative to L5. In this instance, the degeneration of the L4/L5 articulation is due to intersegmental instability and facet arthropathy.

Many forms of non-traumatic transitional vertebrae exist; their morphological expression is highly variable, and they (transitional forms) have been associated with different demographic profiles. For example, isthmic (anterior translation) spondylolytic lesions are less prominent in young females, while adult females appear to be more prone to progressive displacement and may need surgical intervention more often than males. The congenital forms of spondylolisthesis (e.g., dysplastic type) comprise 1421% of all cases of spondylolisthesis and occur in a 2:1 female-to-male ratio, with symptoms beginning around the adolescent growth spurt. Congenital/dysplastic spondylolisthesis has been documented in children as young as 3.5 months; more commonly, however, they go undiagnosed until later in life, after an individual has been ambulating for some time. Degenerative spondylolisthesis also occurs more commonly in females, with a 5:1 female-to-male ratio and the incidence increases after age 40.

In addition to varying by sex, the frequencies of transitional vertebral and lumbosacral vertebral defects also appear to vary by population/ancestry group. A review of the literature finds that sacralization has been observed in 18% of Australian aboriginals (Mitchell), 16% of Indians (Bustami), 10% of Arabs (Bustami), 8.1% of natives of Britain (Brailsford), and 5.8% of Japanese (Toyoda). Bustami studied 340 sacra of two population groups (Arab and Indian). Of these 340 sacra, 46 instances (13.5%) of sacralization were observed, with 32 (9.4%) showing unilateral sacralization and 14 (4.1%) showing bilateral sacralization. Lumbarization was not found in that sample. The incidence of total sacralization was 10% in Arab and was 16% in Indian population groups, with Arab males and Indian females having higher incidences of all stages of sacralization within their respective population groups. Isthmic spondylolytic defects have been found to affect roughly 6.4% of white males and 1.1% of black females. Degenerative spondylolisthesis also affects black females more commonly than white females (and females are more commonly affected than men. Additionally, Eskimo (Inuit) populations are observed to have a very high incidence of spondylolytic defects due to a combination of genetic and environmental factors.

Over the past several years, the authors noted what seemed to be a rather high incidence of abnormal transitional vertebrae and spondylolysis in human skeletal remains under examination at the C.A. Pound Human Identification Laboratory at the University of Florida. These instances were noted on the individuals' biological profile and presented to the medical examiner or submitting agency as unique, individuating characteristics with the associated caveats.

Since 1996, 27 instances total of transitional vertebrae were noted in the total sample of approximately 800 human cases (3.375%). Of these, 16 were males, 11 were females; 22 were European or white (12 M/ 10F) and included two possibly Hispanic males and one possible Hispanic female. Further breakdown reveals one (1) Asian female, one (1) Black male, one
(1) male of mixed or admixed ancestry, and two (2) unknown or unspecified males. Of these, there were 15 instances (to varying degrees) of sacralized L5's, including two cases of ankylosing spondylitis (7M/8F; 13W/1B/1Asian); two instances of spondylolisthesis of L5 (both White males) and six (6) cases of spondylolysis of L5 (5M/1F; 3W/1 "mixed"/two unspecified). Of these 27 two cases presented with cervical ribs that were both White females and two cases with "lumbarized" S1; both White males.

Comparisons show that the frequency of anomalous lumbosacral transitional vertebrae in this modern forensic sample percentage-wise compares, albeit on the low end, favorably with clinical findings of such anomalies in 4 to 8 percent of the clinical population. Thus, the frequency of these defects in the forensic population is not an idiosyncratic characteristic of this population. Despite their frequency within the general population, the presence of and unique morphological configuration of these anomalous vertebrae in a given individual should still be of considerable value to the forensic anthropologist in antemortem versus postmortem identifications.

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