

Sacroiliac joint ankylosis

Palaeoepidemiological study on the Identified Skeletal Collection from the Museu Bocage, Lisbon, Portugal

Carina Marques, Vitor Matos – Research Centre for Anthropology and Health (CIAS), Department of Anthropology, University of Coimbra, Portugal

anac@ci.uc.pt

Introduction

The sacroiliac joint (SIJ) is one of the most complex articulation^{1,2} and for long questioned as to anatomic classification, mobility and pathology. Clinical studies are often limited by the constrains of the roentgenogram analysis.³⁻⁶ The SIJ ankylosis has been reported in relation to musculo-skeletal diseases, e.g. spondylarthropathies (SpA) and DISH,⁷⁻⁹ but also as a common finding on the elderly, specially males, with no pathological implications.^{5,10-13} On bioarchaeology there is paucity of research on SIJ ankylosis, however, the assessment of the typology and palaeoepidemiology are pivotal to a better understanding of the processes underlying this condition.

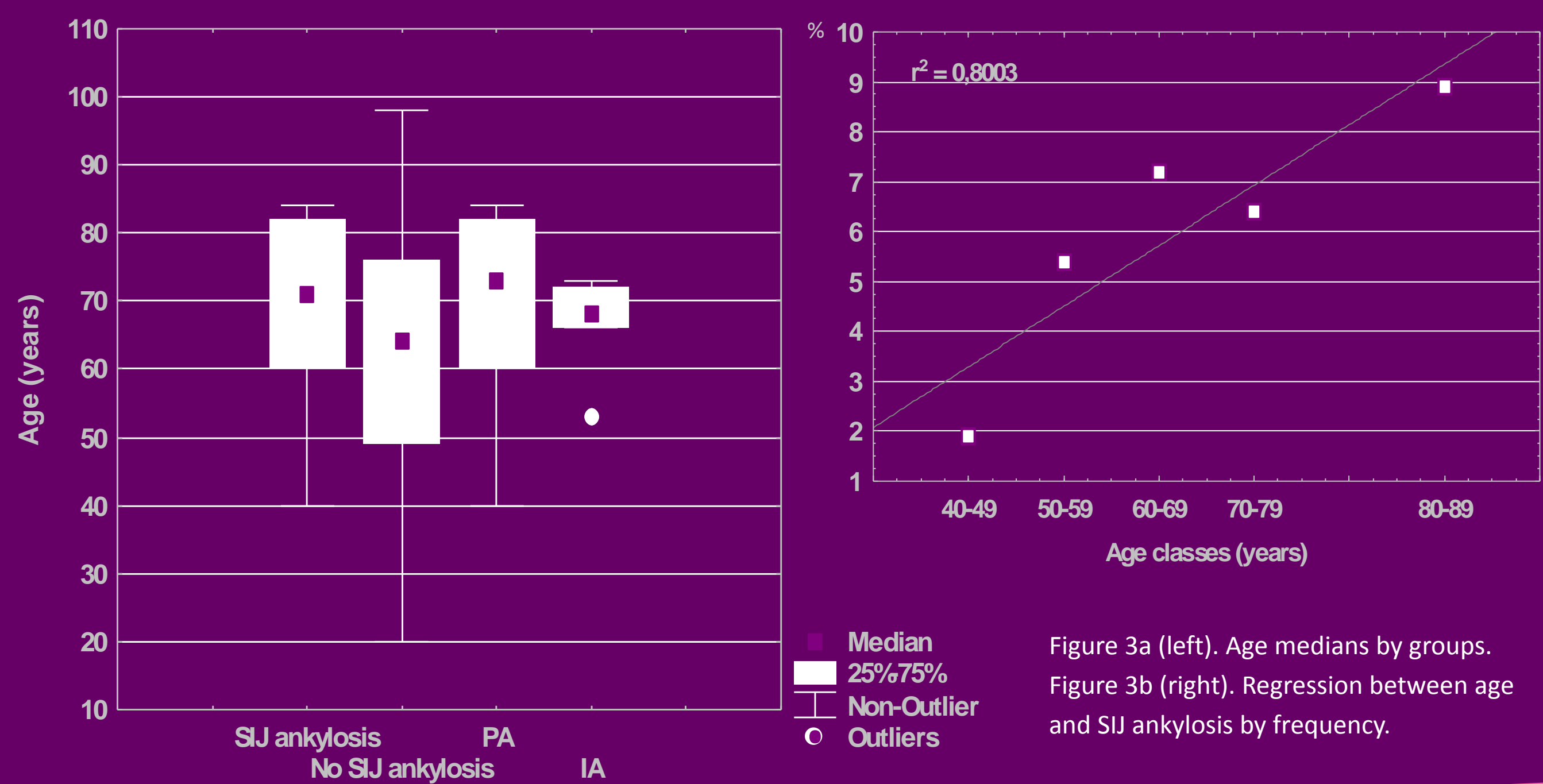
- Macroscopic evaluation of SIJ ankylosis. Cases without complete bridging excluded
- Recording parameters: **typology** (figure 2a and 2b)- para-articular (PA) and intra-articular (IA) differentiated according to Dar & Hershkovitz (2006)⁶, Dar et al. (2007)⁹; **laterality**; **location**- proximal, ventral, distal and dorsal
- Statistical analysis: Pearson Chi-square (χ^2), Mann-Whitney (U), linear regression (r^2). Significance of difference when $p < 0.05$
- A control group (n= 52) was selected randomly amongst those without SIJ ankylosis, in order to investigate the relation between SIJ ankylosis and etiologic factors
- Diagnostic criteria for SpA and DISH according to Rogers & Waldron (1995)¹⁴

Results

- SIJ ankylosis affected 5.2% of the skeletons, mostly by para-articular (PA) form (table 1)
- The overall striking male predominance was imputed by PA, while there was a majority of females affected by intra-articular ankylosis (table 1)
- The bilateral affection was less common (table 1)
- Left (n=7) and right (n=10) side location did not differed statistically ($p = 0.467$)
- Complete extension of the fusion was meagerly noticed (11.5% [3/26]). The mainly involved location was the proximal area of the SIJ (80.8% [21/26])

Table 1. Overall prevalence and pattern of distribution by sex.

SIJ	Total			Male			Female			p (χ^2 Pearson)
	n	%total	%lesion	n	%sex	%lesion	n	%sex	%lesion	
With lesion	26	5.2	100.0	20	8.7	76.9	6	2.3	23.1	0.006
Intra-articular	5	1.0	19.2	1	0.4	20.0	4	1.5	80.0	-
Para-articular	21	4.2	80.8	19	8.2	90.5	2	0.8	9.5	<0.001
Bilateral	9	1.8	34.6	7	3.1	77.8	2	0.8	22.2	0.096
Unilateral	17	3.4	65.4	13	5.6	76.4	4	1.5	23.6	0.029
Without lesion	470	94.8	-	211	91.3	44.9	259	97.7	55.1	0.027
Total	496			231			265			



- Amongst the 5 cases of IA fusion, 3 had simultaneously other pathological signs related with inflammatory arthropathies, possibly spondylarthropathies (SpA)
- A total of 87.7% (18/21) of the cases with PA, presented extensive vertebral bony growths and/or ankylosis (osteophytes, paravertebral ossifications or, less commonly, syndesmophytes). A pattern of DISH was depicted on 47.7% (10/21). Only one case of a possible SpA
- The analysis between the cases and control (n= 52), pointed to a significantly higher prevalence either of general spinal bony growths, or DISH or SpA on the cases ($p < 0.001$, $p < 0.001$, $p = 0.04$, respectively)

Discussion and Conclusion

- Our results lend support to other studies^{5,10,11,13,15-17} (table 2) that point to a sex bias towards males and a strong age correlation. On the present study, the male predominance occurred solely for the PA ankylosis, the most common form. Hormonal and anatomic differences, in terms of SIJ mobility, between sexes were suggested as main underlying factors.^{3,6,15} SIJ ankylosis is also considered a phenomenon consequent from aging.^{5,12,13} However, due to the noticed association between PA and DISH, a disease twice as common in men and more prevalent on elderly,¹⁸ it should not be disregarded as an influence on the overall epidemiological profile of the SIJ fusion
- The highly concomitant occurrence of SIJ fusion and phenomena of generalized axial enthesial bone proliferation, DISH and SpA, suggests an important interplay between these conditions
- Segregation between typology of ankylosis (IA and PA) should be emphasized on anthropological studies
- SIJ ankylosis in other diseases (infections, other inflammatory arthropathies or paralysis¹⁹) were clinically reported but are rarely considered on paleopathological diagnosis

AIMS:

- Report the prevalence and paleoepidemiological profile of SIJ ankylosis
- Comparative analysis with other studies on skeletal identified collections
- Analysis of the impact of pathological conditions on SIJ ankylosis

Human Identified Skeletal Collection from the Museu Bocage (NMNH, Lisbon, Portugal)

- 496 adult (>20 years) skeletons with preservation of the SIJ
- Deceased between the years of 1881 and 1959
- Demographic characteristics of the sample are described on figure 1
- No statistical difference between the percentage of males and females ($p = 0.127$) on the total sample
- Predominance of older age categories (Mean age: Total= 61.2, SD= 18.5; Males= 57.5, SD= 17.2; Females= 64.5, SD= 19.0; $p < 0.001$)

Material Methods

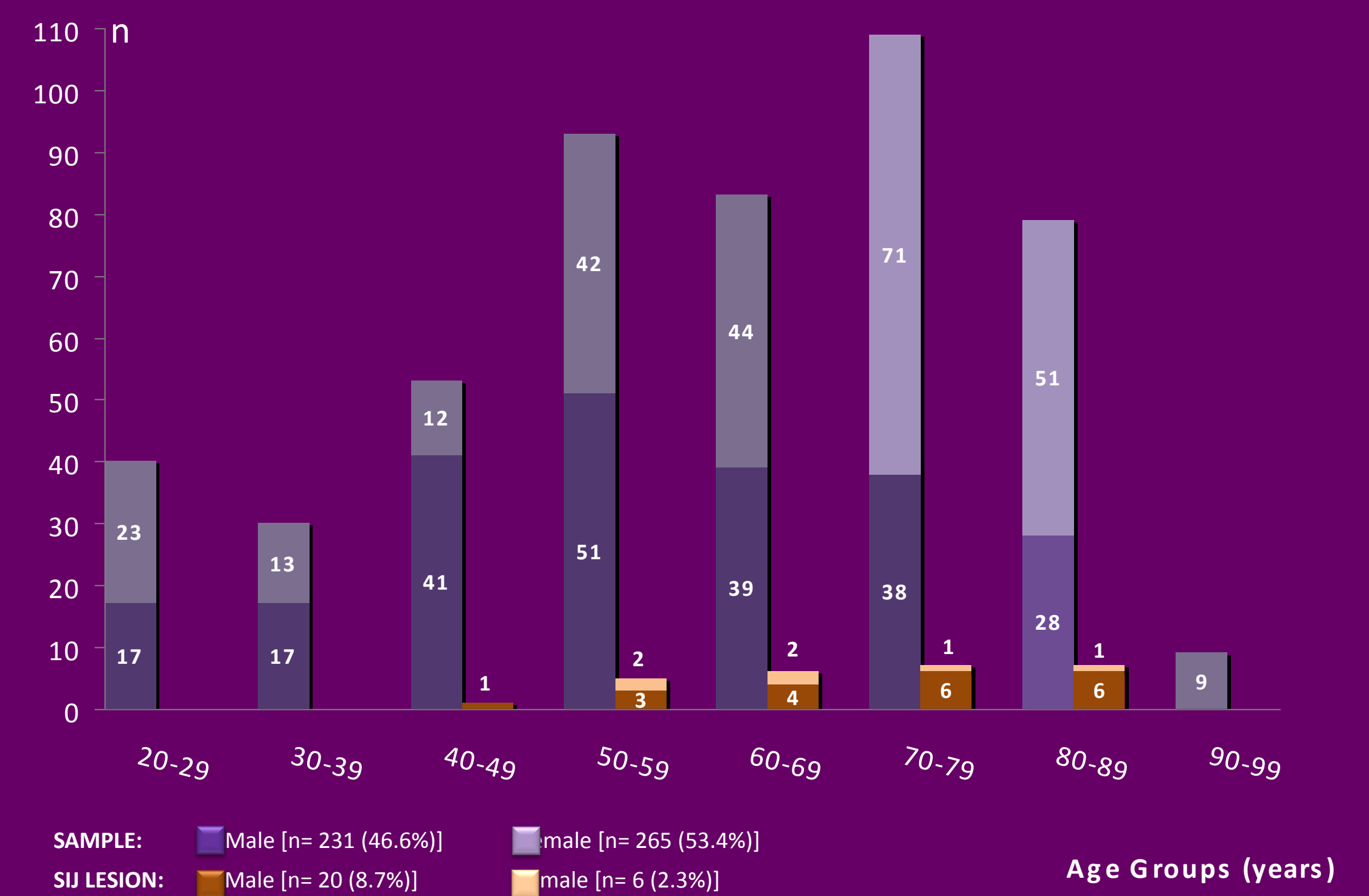
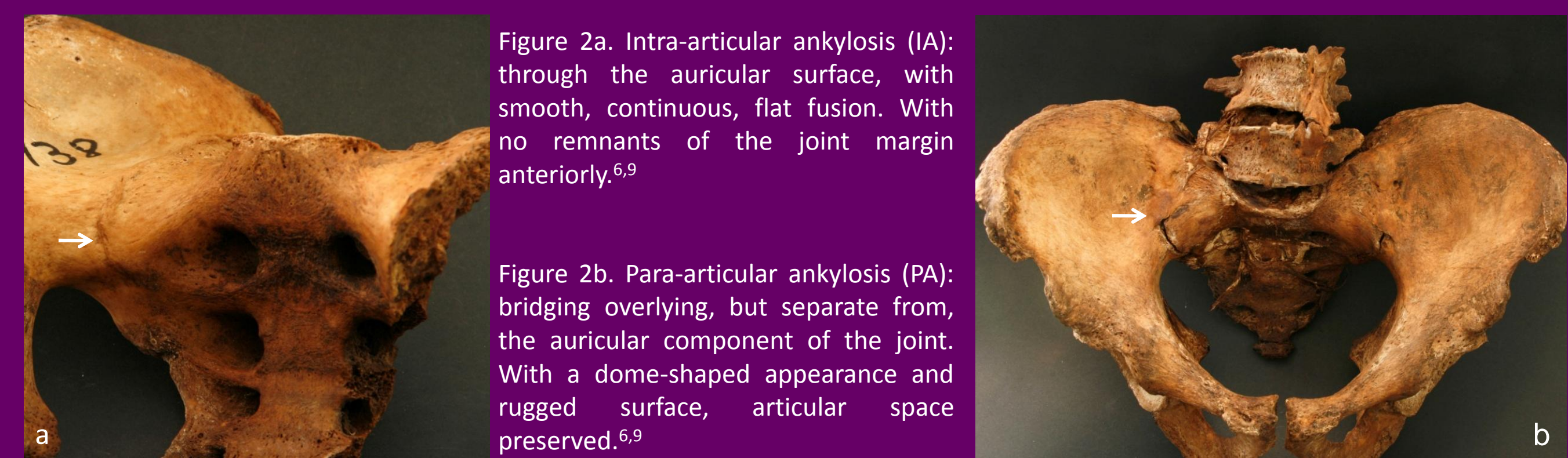


Figure 1. Sample distribution by age classes and sex (purple bars). Cases of SIJ fusion by age and sex (orange bars).



- The lesions were present only in older age categories, with absence of cases under 40-49 years old (figure 1, represented by the orange bars). The regression analysis revealed ($r^2 = 0.8003$) an almost linear increase of the lesion prevalence with age (figure 3b)
- Mean age at death of the group with SIJ lesion (69.5, SD= 12.1) was significantly higher than without SIJ fusion (60.8, SD= 18.7, $p = 0.02$). See also figure 3a
- Differences on mean age at death did not reached statistical significance when comparing PA and IA cases (70.3, SD= 12.9; 66.4, SD= 8.0; $p = 0.278$). See also figure 3a

Table 2. General paleoepidemiological profile on other studies of the SIJ ankylosis.

Report	Chronology	Prevalence	Typology	Sex differences	Overall age	
Human identified Skeletal Collections	Present study ^a	19 th - 20 th	5.2%	PA= 4.2%, IA= 1.0%	M>F [8.7%; 2.3%]*	All cases > 40 years old
	Stewart (1985) ^b	20 th	10%	IA= 0,6%	M>F [13.9%; 3.6%]	Increasing > 30 years old
	Dar et al. (2005) ^c	20 th	10.5%	IA= 3% M; 1.83% F	M>F [12.3%; 1.8%]*	30.3% > 80 years old
Archaeology	Waldron & Rogers (1990) ^d	18 th - 19 th	4.5%	PA= 4.2%, IA= 0.3%	M>F [8.3%; 3.2%]*	All cases > 45 years old
CT images (in vivo)	Dar et al. (2008) ^e	21 st	16.7%	PA= 100%	M>F [27.7%; 3.0%]*	51.3% > 60 years old
Dissecting room specimens	Brooke (1924) ^f	20 th	18.6%	NA	M>F [100%; 0%]	All cases > 50 years old
	Sashin (1924) ^g	20 th	ND	PA= 100%	M>F [NA]	All cases > 40 years old
	MacDonald & Hunt (1952) ^h	20 th	10.2%	IA= 2 cases	NA [male sample]	All cases > 60 years old

(a) Human Identified Collection of the Museu Bocage, Portugal; (b) Terry Collection, USA and Dart Collection, South Africa; (c) Hamman-Todd Human Osteological Collection, USA; (d) Christ Church, Spitalfields, England; (e) Carmel Medical Center, Israel; (f) Guy's Hospital Medical School, England; (g) Information not available; (h) Sunnybrook Veterans' Hospital and Hospital for Sick Children, Canada.

M= males; F= females
NA= not available
*= statistical differences ($p < 0.05$)

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Acknowledgments and financial support:

The authors would like to express their gratitude to: Centro de Investigação em Antropologia e Saúde (CIAS), Fundação para a Ciência e a Tecnologia [grant numbers: SFRH/BD/16155/2004; SFRH/BD/30038/2006], Museu Bocage, César Marques, Ana Luisa Santos, Eugénia Cunha, Don Otner, Cláudia Umbelino, Hugo Cardoso.