Development anomalies of the vertebral column in Portuguese Prehistoric samples

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INTRODUCTION

The spine can provide a large amount of information about an individual’s physical condition, lifestyle, epidemiology and familial links of birth defects. The aim of this research was the analysis of developmental anomalies of the vertebral column of Portuguese Middle/Late Neolithic and Chalcolithic skeletal collections. These were recovered from collective tombs, were the bones are found disturbed, very fragmented with few or complete absence of anatomical connection. Despite these limitations, several developmental anomalies of the cervical and thoracic part of the spine were observed.

MATERIAL

This study includes the human remains recovered from 4 collective burials dated to the Late Neolithic/Chalcolithic, except Lugar do Canto from the Middle Neolithic period (Figure 1):

- Natural cave of Lugar do Canto (1);
- Tholos de Paimogo I (2);
- Tholos Praia da Samarra (3);
- Hipogeu de São Paulo II (4);

Figure 1: Geographic location of the analysed samples.

The human remains were recovered without anatomical connection and fragmented. The present analysis includes data from cervical and thoracic region of the spine.

METHODS

Developmental anomalies were scored according to Barnes (1994);

For block vertebrae, the classification followed the definition of Barnes (1994) and Pany and Teschler-Nicola (2007):

Type I: involves several cervical and thoracic vertebrae confined in one osseous block that usually signals major additional defects;

Type II: fusion of two or three vertebrae in the cervical region, usually C2 and C3 or C5 and C6; less commonly T2 and T5. Hemivertebrae and occipitization may also be present.

Type III: typically involves block cervical vertebrae with additional thoracic and lumbar segmental errors.

RESULTS

All defects were observed in adult individuals except the case of Praia da Samarra, that belongs to a non-adult that died between 12 and 17/19 years. These include:

- Developmental delay of vertebral elements (cleft neural): Atlas bipartita and cleft posterior arch of atlas (Table 1);
- Segmentation errors (Failure of segmentation): block vertebra (Table 2);

Table: Type of defect: Failure of segmentation

<table>
<thead>
<tr>
<th>Site</th>
<th>Type of Defect: Failure of Segmentation</th>
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<tbody>
<tr>
<td>Lugar do Canto</td>
<td>C7-C3 Block vertebrae (NMI C7 provisional: B); C3-C7 Block vertebrae; 2 cervical block vertebrae; 1 thoracic block vertebrae.</td>
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<tr>
<td>Tholos de Paimogo</td>
<td>C7-C3 Block vertebrae (1/48 = 2.1%) (Figure 4); 1 thoracic block vertebrae (Figure 6).</td>
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<tr>
<td>Praia da Samarra</td>
<td>C1-C3 Block vertebrae (Possible hypoplasia of dens axis*) (Figure 5).</td>
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Superior view

Inferior view

Figure 2: Atlas bipartita recovered from Tholos of Paimogo I.

Figure 3: Cleft posterior arch of atlas exumed from the Hipogeu de São Paulo II.

Figure 4: C2-C3 block vertebrae recovered from Tholos of Paimogo I.

Figure 5: C2-C3 block vertebrae recovered from Praia da Samarra associated with a possible case of dens hypoplasia.

Figure 6: Thoracic block vertebrae recovered from Tholos of Paimogo I. Lateral view; X-ray –Lateral view; posterior view.

DISCUSSION

The most frequent defect observed was C2-C3 vertebral blocks (Figures 4 and 5). A rare thoracic block vertebrae was also registered (Figure 6). In all, trauma and degenerative origin can be excluded due to the absence of osteophyte formations. These defects could correspond to possible cases of Klippel-Feil syndrome (KFS). KFS is a complex congenital disease that results from an interruption of the normal segmentation of vertebrae during the second to eighth week of gestational development. Diagnoses is established with the presence of, at least, 2 fused cervical vertebrae. Clinically, it can be associated to several symptoms and anomalies, like short neck, limited neck range of motion, low posterior hairline. KFS patients are particularly vulnerable to spinal canal compromise and spinal cord compression. Unfortunately, the isolate nature of these vertebral blocks don’t allow a more conclusive diagnosis. In one case, Samarra, another development defect was found associated: presence of dens hypoplasia (Figure 5).

Atlas cleft neural defects, that is, defects due to developmental delay of vertebral elements were noted in two samples. Clefting of posterior arch of atlas, the most common defect of this type, was observed in São Paulo II collection. A rarer defect, atlas bipartita, was found among the recovered remains of Paimogo I.

FINAL REMARKS

Although the main limitation of the nature of the samples, recovered from collective tombs, with very fragmented and disturbed bones with few or complete absence of anatomical connections, some relevant data about development defects of the spine of these prehistoric individuals were obtained. Besides the documentation of defects of several types, the importance of these disorders also lies in the fact that they can serve as indicators of the degree of homogeneity in populations. Therefore, they can help in reconstructing genetic relationships among populations and social aspects associated with inbreeding or certain marriage practices.

The relatively high frequency of vertebral blocks in the Lugar do Canto sample, allow to infer small population size or population isolation. In fact, this is the oldest sample, and the only one dated to the Middle Neolithic.

Bibliography


