

The Accuracy of the Osteological Sexing of Cremated Human Remains: A Test Based on Grave Goods from East Lithuanian Barrows

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ABSTRACT

The accuracy of the sex determination of cremated human remains is one of the vital parameters for archaeologists and skeletal anthropologists dealing with cremations. Few studies have so far aimed at testing it. In the present paper, the accuracy of the sexing techniques was assessed by paralleling biological sex (identified morphologically) to gender (presumed on the basis of the grave goods which accompanied the deceased). A collection of cremated bones from East Lithuanian barrows (c. fourth/fifth – eleventh/twelfth centuries AD) was employed. The fragmentary nature and poor state of the bones generally represents cremains from similar archaeological contexts. The database inevitably underwent several stages of filtration. Out of 364 cremations with a minimum of 445 individuals, only 157 were sexed single adult burials, of which only 81 had »gender-related« grave goods. The relationship of artefact type to gender was defined statistically, revising the results in line with the chronological and typological differences and the probable symbolism of the grave goods. Sex and gender coincided in 56 cases (69.14%), but a considerable distance between the results for both sexes was observed. Biological females displayed a fairly high match level, i.e. 35 out of the 41 (85.37%) individuals osteologically identified as females had been given »feminine« items. The burials of biological males, on the other hand, yielded a surprisingly low match rate, i.e. only 21 out of 40 (52.50%). This disparity suggests a possible misinterpretation of grave goods as gender markers, rather than (only?) erroneous sexing. It is thus argued that for females, the mean value for the accuracy of sexing is 85.5%. In most cases, such precision is entirely satisfactory for the analysis of a poorly-preserved osteological material. For males, however, the accuracy is likely to fall somewhere in the range between 52.5 and 85.5%, with the applied methodology so far failing to contribute to higher precision.

Key words: cremation, sexing techniques, accuracy, sex, gender, grave goods, East Lithuanian barrows

Introduction

As the practice of cremating the dead has been common globally, burned bones often comprise a considerable percentage in the collections of human remains that are employed by skeletal archaeologists and anthropologists in their studies. For numerous past populations and periods, cremations are the only source of data available for research in paleodemography, bioarchaeology, and mortuary archaeology in general.

Osteological analysis faces a multitude of difficulties when dealing with cremains. It is burdened by factors ranging from burial customs to archaeological excavation techniques¹⁻⁹, i.e. the diverse cremation rituals practiced in particular societies, the different types of fuel for the

pyre, the various cremation processes, which might have caused uneven thermal changes in the bones, the treatment of the remains between their collection from the pyre and their interment, the environmental impact, the level of the site's disturbance, the excavator's competence and accurateness, etc. Since these are all variables, the remains available for osteological analysis can vary from several kilograms of massive bones to merely grams of ashes.

Detailed inquiries into cremated bones^{1,10-15} are rarely the primary scope of archaeologists who focus chiefly on the results of the osteological analysis, avoiding a discussion of its methods and their validity. Effective exploitation of the osteological data depends on their reliability. Anyone who employs an osteological record (sex, age at

death, etc.) in any sort of research will find the value of its accuracy vital for a broad spectrum of interpretations.

The present paper seeks to estimate and discuss the accuracy of the osteological sex determination of cremated remains. It should come as no surprise that the potential of osteology in this task is much lower when examining cremains^{1,11,13,16-19} than inhumed remains^{20,21}. Some researchers have proposed values for this parameter^{1,10,22}. Such inquiries, however, are not only insufficient in number but also provide rather conflicting results. There is a considerable lack of studies that encompass variant materials and sexing methods. The interests of forensic anthropologists and archaeologists seldom meet at one point.

The collection of bones that were obtained from so-called East Lithuanian barrows (dated to the c. fourth/fifth – eleventh/twelfth centuries AD) and are currently being stored at the depository of the Department of Anatomy, Histology and Anthropology, Faculty of Medicine, Vilnius University, was used to shed some new light on the capabilities of osteology in sexing cremated bones. Being of diverse and rather fragmentary nature in respect to both quantity and state of preservation, this collection generally represents average osteological material of approximately the same period and cultural background. Grave good assemblages were addressed as a means of verifying osteological sexing.

The most relevant approach for meeting the study's aim would definitely be to use a sample of cremated bones of known sex. Cremation practices, however, were abandoned in Lithuania and the adjacent countries in the fifteenth century AD at the latest, and not a single cremation burial with the sex recorded is available for analysis. Contemporary cremated bones, if any were even accessible for experiments, would not serve as apt material, since modern cremation techniques vary considerably from those known to bygone societies. This leaves the evaluation of grave good assemblages as the only criterion, even if it is a somewhat confusing one (see below), for testing the reliability of the burial material using the same database. Similar attempts using inhumation burials^{23,24} have resulted in a fairly high level of success.

Materials and Methods

Determination of biological sex

The database used in the study consists of 364 morphologically analysed burials of cremated humans (37.4% of all those excavated in the region over roughly one and a half centuries) that were found in 55 barrow cemeteries. The remains of at least 445 individuals were identified, yielding 157 cases of usable osteological sexing after the exclusion of the subadult, unsexed adult, and group burials. The last were excluded from the calculations because they do not permit the association of specific grave goods to any of the individuals in the burial.

Although the depository possesses even more analysed cremated bones from other contemporaneous cemeteries,

only those from the East Lithuanian barrows were used. This burial site category is highly distinguished for specific grave good assemblages. Its selection enhances the potential of the method applied here, as will be argued below.

Sex determination was based on the macroscopic examination and measurement of the sexually dimorphic bones, while taking into consideration their deformations, warping, and shrinkage. In most cases, the morphological analysis and sex determination was performed by the same researcher, thereby minimizing inter-observer variability. In all cases, the grave inventories were unknown to the skeletal biologist, i.e. sex determination was performed as a blind test. The informative bone fragments that were identified the most frequently among cremains were those of the cranium: supraorbital ridge of the frontal, the temporals, the zygomatics, the occipital, the maxilla, and the mandible^{25,26}. Measurements were made of the fragments of the mandible, the temporals, the zygomatics, the frontal, the vault wall, the odontoid process of the axis, the glenoid fossa of the scapulae, and the epiphyses and diaphyses of the femur, the humerus, the radius, and the other long bones in line with the standards proposed by Gejvall¹⁰ and Van Vark²⁷ (since the shrinkage level might be uneven in different bones, sexing based only on isolated measurements was avoided). In isolated cases, the general robusticity of the bones was visually evaluated. The fragments of pelvis fit for sexing^{25,26,28} were rarely identified and did not noticeably advance the analysis. This is expected to have a substantial negative influence on the results. On the other hand, the complete crumbling of the pelvic bones due to combustion is typical, and



Fig 1. Cremated human bones from burial 1, barrow 14(70?), Gudeliai, Lenkiškės barrow cemetery (photo: L. Kurila).

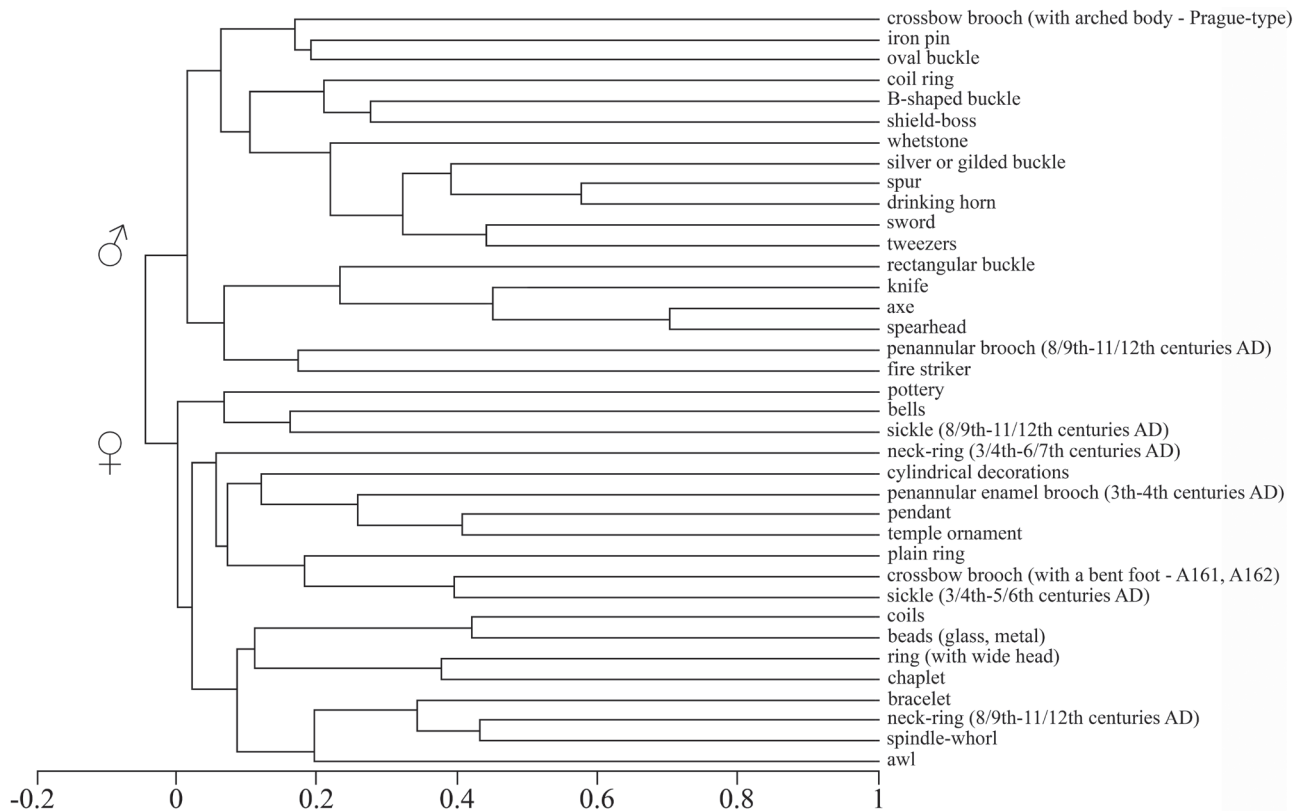


Fig 2. A dendrogram of the relationship between the grave good types based on the number of occurrences in one assemblage.

so the potential to employ them in analysis is tenuous. Since the studied cremations contained highly varying quantities of bones (from 2 to 2657 grams, the average being 419 grams) (see Figure 1), appealing to such criterion as the weight of the remains²⁹⁻³¹ was impossible. The final decision in each case was based on a summation of the arguments. The remains were sexed with a varying degree of certainty (male, probable male, unsexed, probable female, female), but this was not included in the calculations.

The age at death was estimated alongside the sexing of the cremains and was based predominantly on the scale of cranial suture closure^{25,32,33}, dental formation and eruption³³⁻³⁵, epiphyseal fusion of the long bones^{11,34}, and vertebral growth and osteophyte development³⁶. The determination of the minimum number of individuals, which was essential in order to eliminate group burials, was based mainly on the duplication of the single and paired bones of the skeleton: the petrous pyramids of the temporals, the frontal, the occipital, the maxilla and the mandible, the odontoid process of the axis, some of the long bones, etc. and sometimes also on unduplicated bones from individuals of obviously different sex or age. Those burials where an unrelated bone might have been accidentally included in the grave were still treated as a group burial for the purposes of this study.

Grave good to gender relationship?

A general trend exists in the burial archaeology of European Barbarian societies to relate weapons to males and most of the ornaments as well as household items to females (of course, considerable differences may occur between different societies)^{23,24,37-41}. Although this paradigm receives a certain amount of criticism (see below), no better universal level conceptions have been proposed. This course, while preserving some cautiousness and anticipating some relatively rare exceptions, is also followed in this paper. This, however, needs a much more careful approach than a simple assumption. Therefore an effort was made to employ statistical methodology in defining »engendered« grave goods specifically for the society under discussion. Attempts to identify other archaeological gender determinants, i.e. grave construction, position in a barrow, etc. yielded only very vague results that did not assist in the evaluation.

To establish the presumptive relationship of specific types of grave goods to either sex, 321 assemblages containing three or more items (from both osteologically analysed and unanalysed burials) in East Lithuanian barrows were analysed statistically. These included both earlier inhumations (third/fourth – fifth/sixth centuries AD) and later cremations (fourth/fifth – eleventh/twelfth

TABLE 1
GRAVE GOODS AS PROBABLE GENDER INDICATORS

Gender	Grave goods
Male	sword, axe, spearhead, shield-boss, spur, bridle-bit, stirrup, whip-handle, sickle (eighth/ninth – eleventh/twelfth centuries AD), whetstone, fire striker, tweezers, drinking horn, crossbow brooch (with arched body – derivative of Prague-type)
Probable male	knife, buckle, iron pin, penannular brooch (eighth/ninth – eleventh/twelfth centuries AD)
Unidentified	loop, coil ring
Probable female	neck-ring (third/fourth – sixth/seventh centuries AD), ring (all/unknown types), penannular enamel brooch (third – fourth centuries AD), pottery (pots, shards)
Female	awl, needle, sickle (third/fourth – fifth/sixth centuries AD), spindle-whorl, chaplet, temple ornament, beads and pendants (glass-enamel, metal), neck-ring (eighth/ninth – eleventh/twelfth centuries AD), bracelet, ring (plain, with a wide head), crossbow brooch (with a bent foot – Almgren 161, 162), coils, cylindrical decorations, bells

centuries AD), as they all contain generally similar sets of grave goods. Items which do not survive cremation, e.g. amber beads, are also rare in inhumations and thus the manner of burial is not a crucial factor, which could distort the results.

A dendrogram was created to assess the proximity of the artefact types (cluster analysis, distances calculated using the Pearson correlation coefficient). This operation segmented all of the types into two poles which are likely to be related to the masculine and feminine genders (see Figure 2). The statistical analysis demanded the precise preparation of the data, which definitely had an even greater impact on the results than the selection of the statistical instrument to be used. For example, the early type of sickle mainly occurs in assemblages with female ornaments, while the late type accompanies mainly horse burials and is thus reckoned to be an equestrian, i.e. male, symbol in human burials. Such ornaments as crossbow and penannular brooches or neck-rings display considerable typological changes over the course of time, whereas some of the other ornaments do not. To obtain an applicable result, the database needed to be regrouped several times in accordance with the differences in typology, chronology, production material, etc.

Blind statistics, however, did not seem to be entirely sufficient to define a reasonable gender-to-artefact relationship, e.g. weapons appeared to fall fairly near to the »feminine« pole of the dendrogram, or the late type of sickle was attributed to the »feminine« goods. The results were evidently distorted by several elaborate assemblages and some rare types. In addition, several types, such as the needle, appeared only in sets smaller than three items and were thus excluded from the dendrogram. The distribution of the grave good types was submitted for further revision in light of the aforementioned factors, the possible social and symbolic content of the grave goods, the probability of some of the graves having been looted, the fact that many of the analysed burials were actually subadult or group burials, and also after referring to any analogies and scarce written sources, e.g. a narration about the burial practices of the West Balts by Wulfstan of Hedeby (late ninth century AD)⁴² or the depictions of the funerals of the

grand dukes of Lithuania in the fourteenth century AD⁴³. The revised list of »engendered« grave goods is given in Table 1. Each of the grave good assemblages found in the 157 osteologically sexed burials was then individually classified as »masculine«, »feminine« or »ungendered«, in accordance with both the dendrogram and the subjective evaluation of the items (or, of course, in the absence of any).

Out of the 157 single burials of sexed adults, only 81 (41 burials of biological females and 40 of biological males) contained »gender-related« grave goods. This comprises only 22.25% of the whole collection, and 8.3% of all of the cremations excavated in the East Lithuanian barrows. The burials directly used in the study are scattered in 27 barrow cemeteries (see Table 2 and Figure 3).

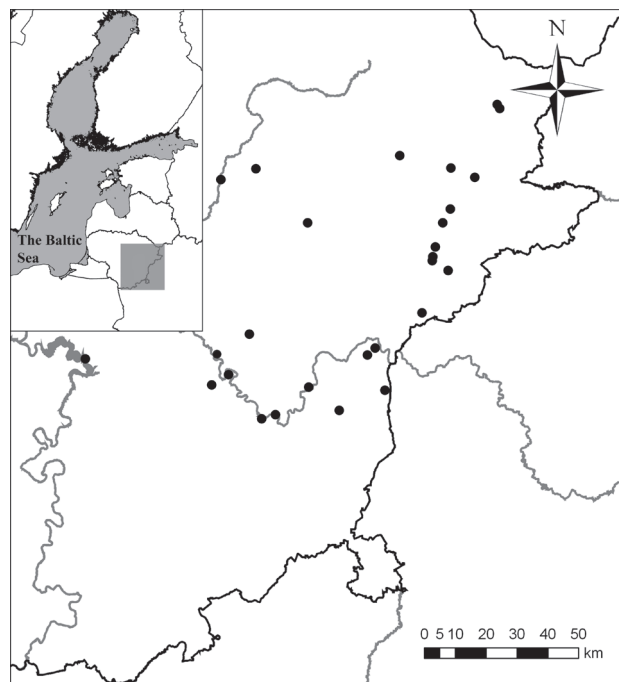


Fig 3. The locations of the barrow cemeteries used in the study.

TABLE 2
THE BARROW CEMETERIES AND OSTEOLOGICALLY ANALYSED
CREMATIONS USED IN THE STUDY

Barrow cemetery	Cremations analysed, total	Adults with »engendered« grave goods	
		Females	Males
Aleksandriškės, Pukštėnai	5	2	
Ažušilė	10		1
Baliuliai	11	2	2
Grabijolai, Žemaitiškiai II	5		3
Gudeliai, Lenkiškės	14	3	1
Jakšiškis	12	3	1
Kapitoniškės	19	1	1
Kretuonai	47	7	5
Kurklių šilas	3		1
Miškiškiai, Aktaapolis	1		1
Neravai, Grigiškės	48	5	2
Padūkštai	3	2	
Paduobė, Šaltaliūnė III	35	2	6
Pakalniai I	5	1	1
Peršaukštis, Kasčiukai II	4		1
Rėkučiai, Pakretuonė	3		1
Santaka	7	1	2
Staviškės	2	1	1
Sudota I	11	2	3
Sudota IV	2		1
Tauragnai	1		1
Turlojiškės	3	1	
Vaišniūnai, Medžiukalnis	1	1	
Varlišškės	21	2	3
Vigodka, Dūkštas I	4	2	
Vigodka, Dūkštas II	8	1	1
Žvirbliai	16	2	1
Total:	301	41	40

Results

Sex, identified osteologically, and gender, presumed on the basis of the grave goods, coincide in 56 cases (69.14%). What attracts the most attention is the substantially unequal match rates for the identified biological males and females. As many as 35 out of 41 (85.37%) biological females were given »feminine« grave goods, while the match rate is considerably lower for biological males: 21 out of 40 (52.50%) (see Figure 4). The discrepancy in the values is statistically significant ($p < 0.05$). It cannot be ignored, and should probably be explained through the uneven rele-

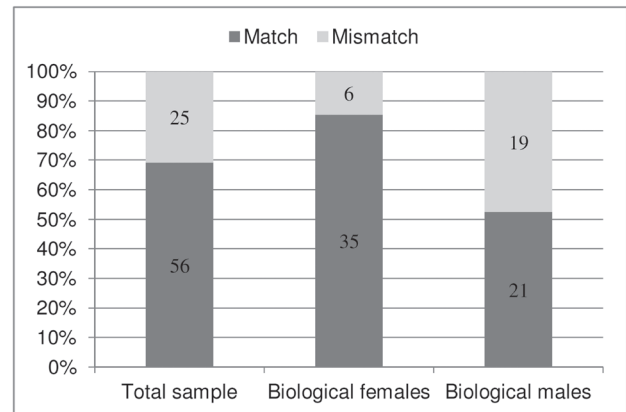


Fig 4. The relationship between biological sex, determined osteologically, and the gender, determined on the basis of the grave goods.

vance of either of the applied methods (sexing or gendering) when examining male and female burials.

The fact that the sex/grave good match rate correlates with the degree of certainty of osteological sexing is also worth mentioning. In 3 of the 6 (50.0%) mismatch cases among the biological females, the osteological sexing results contained the note »probable«. But only 5 out of the 19 (26.3%) biological males interred with »feminine« items were identified as »probable«, the rest of the cases being definite.

No substantial differences were observed between the assemblages from the biological male and female burials that contained »masculine« grave goods, and vice versa, between those that contained »feminine« items. On the other hand, the degree of gendering reliability seems to be unequal between males and females. In all of the mismatch cases, the burials of biological females contained weapons, i.e. axes and/or spearheads, which are likely to serve as solid »masculine« gender indicators. In the above-mentioned 19 mismatched biological male burials, the »feminine« grave goods were not only those with a »definite gender« (e.g. awls, sickles, spindle whorls, and typical ornaments), but also those which might only cautiously be considered »feminine« (e.g. ornaments that are very fragmented or melted and thus hardly identifiable). In fact, only 5–7 biological males had fairly large »feminine« grave good assemblages.

The attempts to detect any chronological or territorial regularities from the discussed point of view were in vain. Hence the data can be further approached as a whole, and the impact of the cultural diversity is minimal.

As available comparative data, 30 inhumations from the same cultural background but a somewhat earlier period (third/fourth – fifth/sixth centuries AD) were examined. In 24 (80.00%) burials, the grave goods were in accordance with the biological sex. Interestingly, biological males also displayed a higher mismatch rate, i.e. 5 out of 16 (31.25%) had »feminine« grave goods, while in only one case out of 14 (7.14%) was a biological female given »mas-

culine« items. The results thus generally correspond to those obtained through the cremation analysis; however, they are statistically insignificant due to the small database and the fact that four of the biological male mismatch cases occurred in one cemetery.

Discussion

In the past decades, a great deal of scepticism has been seen in archaeology in respect to the way grave goods reflect the sex of the deceased. The divide between the concepts of »sex« and »gender« has grown considerably in archaeological thought⁴⁴. Past societies and, or even more so, their burial grounds and mortuary deposits, are perceived as multipolarly engendered rather than bipolarly sexed^{45–49}. The nature of the relationship between sex and gender becomes even more intricate when a third component of burial practices and grave goods is added. In general, this critique has much to do with the stream of gender archaeology and postprocessual attitudes towards burial. Grave goods, it is argued, should not be approached as merely everyday gear disposed along with its dead owner. Items, when they enter a burial as grave goods, acquire symbolic meanings^{50–53}. Gender is only one of the many factors, such as age, social status, ideology, domestic roles, warfare, the social claims of the mourners, etc., that determine the mortuary practices and grave goods that accompany the deceased into the afterlife⁵⁴. Clues for deciphering the way grave goods signal gender are perhaps even more puzzling than are the techniques for sexing cremations. Still, few, if any, studies have reasonably denied the very fact of the relationship between the deceased«s sex/gender and the grave goods.

Reading grave good symbolism is a challenge, but less so when dealing with an isolated region with specific mortuary practices. Although no rule, symbols endemic in one cemetery are also likely to operate in the cemetery of another cognate community. East Lithuanian barrows which represent a unique culture in archaeological terms or the Lithuanian tribe in historical ones⁵⁵, are highly dissimilar from the cemeteries in the other surrounding Baltic regions. Throughout almost the entire period that the barrow cemeteries were in use, the burials were given very distinctive and somewhat standardised assemblages. Their nature and relatively poor content allow one to draw a fairly solid framework for an intrinsic system for the relationship of the grave goods to gender and other identities. As was stated, when defining grave goods as gender markers, an attempt was made to best assess their presumptive symbolic content. This, however, was based on the author«s insight and personal experience in researching East Lithuanian barrows, strengthened by statistical analysis, rather than on any objective criterion.

It can be argued that the overall mean value of 69.14% for a match between the determined biological sex and the »engendered« grave goods suggests that a macroscopic analysis of poorly preserved cremated remains can succeed approximately 69% of the time. For biological females, the sex determination can achieve even better re-

sults, i.e. an 85.5% success rate, which is often an applicable degree of confidence.

What seems the most confusing in the results is the discrepancy between biological females and males in respect to the grave goods they were furnished with. The low 52.50% match rate for males leads one to question whether this is the result of false osteological sexing, or a misinterpretation of »engendered« grave goods. The first possibility would suggest that only 21–33% of the sample were actually biological males, which seems unlikely considering the absolutely random formation of the database and the absence of evidence of any other factors able to bias the record. Moreover, the very nature of the cremated remains should instead condition a reverse error. Due to the shrinkage of the bones in the cremation process^{1,22,33,56}, the error in sexing burned remains is expected to drift conversely, i.e. for biological males to be identified as females. Other researchers report that both decreases and increases in bone dimensions occur during cremation¹⁷. As has been pointed out recently, male and female bones may respond differently to heating^{57,58}. But this is also unlikely to cause an excess of identified males in the sample.

Another possibility is thus more probable, i.e. that some males burials were given »feminine« grave goods. An attempt to compare the grave good assemblages of biological males of different ages was in vain, i.e. a very similar number of younger and older adult males had »masculine« items. While leaving ample space for other possible interpretations (acquired or ascribed social roles, engagement in specific economic duties, engagement/disengagement in warfare, leadership, slavery, etc.), the crucial point for the undertaken topic is the fact that for males, grave goods do not serve as a suitable instrument for verifying the accuracy of the sexing techniques, like they do for females. Some of the »feminine« grave goods may have been erroneously identified as such and somewhat increased the number of »female-gendered« individuals. For a similar reason, more biological males than females could have been classified as »ungendered«, thus distorting the gender ratio.

What is almost certain is that the reliability of the osteological sexing of cremated male bones is somewhat above the minimum value of 52.5%. The question of whether it can actually be as high as for female bones remains rather in the realm of speculation. One can only imagine that for a society consisting of roughly equal percentages of adult males and females, a determination error in favour of one sex should result in a similar error for the other one. This direction, however, prompts a series of queries that are beyond the key scope of this paper: the sex ratio in the communities, the familial models and the possible inflow of females from outside, the probability of some sort of selective burial practices, the chance that the males suffered a violent death in remote military campaigns, etc. Those topics still lack comprehensive research for the society under discussion.

When discussions enter the field of worldviews and images of the afterlife, little can be said for sure. The method applied in this study can hardly be sufficiently

developed at any time to become an instrument powerful enough to precisely evaluate the accuracy of osteological sexing techniques. The use of »engendered« grave goods thus provides results of an interpretative character, which, on the other hand, are all that can be achieved for many past societies.

Conclusions

The probability of a cremated adult female skeleton being osteologically identified correctly can be argued to reach a value as high as 85.5%. For material in a low state of preservation, like that under discussion, this percentage is even higher than was expected and it gives rise to an optimistic outlook for the work in many fields of research that require the contribution of osteological data. This, notwithstanding, does not deny that the above value should be used with a great deal of caution.

As for the adult male remains, the situation is much more complex. If the marginal low value of 52.5%, i.e. nearly a simple guess, for the accuracy is accepted, this would virtually make osteological sexing irrelevant. The true value evidently lies somewhere between 52.5 and 85.5%, but so far it remains obscure. The study did not result in the obtaining of precise number.

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TOČNOST OSTEOLOŠKI OG O DREĐIVANJA SPOLA KOD KREMIRANIH LJUDSKIH OSTATAKA: TEST NA TEMELJU GROBNIH PRILOGA IZ GROBLJA U ISTOČNOJ LITVI

SAŽETAK

Točnost određivanja spola kremiranih ljudskih ostataka jedan je od vitalnih parametara za arheologe i antropologe koji se bave kremiranjima. Nekoliko istraživanja su do sada bila usmjerena na testiranje. U ovom radu, tehnika određivanja spola je procijenjena uspoređujući biološki spola (identificiran morfološki) i rodni spol (pretpostavljen na temelju grobnih priloga koji su pratili pokojnika). Korištena je zbirka kremiranih kostiju iz groblja iz Istočne Litve (4 st./ 5.st – 11.st. / 12.st. P.K.). Fragmentiranost i loše stanje kostiju općenito predstavlja kremirane ostatke iz sličnih arheoloških konteksta. Baza podataka je neminovno prošla nekoliko faza filtracije. Od 364 pogreba uz kremiranje s najmanje 445 osoba, za samo 157 od njih je utvrđen spol i da je riječ o jednoj osobi. od kojih je samo 81 imao grobove s grobnim prilozima koje upućuju na određeni spol. Odnos tipa artefakta i spola je definiran statistički, revizijom rezultata u skladu sa kronološkim i tipološkim razlikama i vjerojatnom simbolikom grobnih priloga. Spol i rod se poklopio u 56 slučajeva (69,14%), ali je uočen znatan razmak između rezultata za oba spola. Biološke ženke prikazuju prilično visoku razinu podudarnosti, odnosno 35 od 41 (85,37%) osoba je osteološki identificiranih ženki su imale »ženske« grobne priloge. Ukopi bioloških muškaraca, s druge strane, je imao iznenađujuće nisku stopu podudarnosti, odnosno samo 21 od 40 (52,50%). Ova razlika ukazuje na moguća pogrešna tumačenja grobnih priloga kao rodni markera, a ne (samo) pogrešna procjena spola. Zato se tvrdi da je za žene, srednja vrijednost za točnost procjene spola 85,5%. U većini slučajeva, takva preciznost je sasvim zadovoljavajuća za analizu slabo očuvanih osteološkog materijala. Kod muškaraca, međutim, točnost će se vjerojatno nalaziti negdje u rasponu između 52,5% i 85,5%, a primijenjena metodologija dosad nije uspjela doprinijeti većoj preciznosti.