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Lessons from Srebrenica: The Contributions and Limitations of Physical Anthropology in Identifying Victims of War Crimes

ABSTRACT: In July 1995, the town of Srebrenica fell to Bosnian-Serb forces, leaving more than 7000 Muslim men missing and presumed dead. Anthropologists participating in the identification process were faced with a unique problem: the victims appeared identical. All were adult males of a single ethnic group. Decomposition as well as the absence of antemortem (AM) medical and dental records confounded identification. As of December 1999, only 63 men had been positively identified using DNA, personal effects, and identification papers. Are current anthropological methods of sex, age, and stature estimation and AM trauma assessment sufficiently accurate to differentiate the remaining victims and aid in their identification? Comparisons of relative-reported AM information and postmortem examination records for 59 of the 63 identified individuals indicated that while all individuals were sexed correctly, only 42.4% were accurately aged and 29.4% had a stature estimate that included their reported height.

KEYWORDS: forensic science, forensic anthropology, Balkans, human rights, personal identification, stature estimation, age estimation

The past decade has seen a dramatic increase in the number of physical and forensic anthropologists participating in genocide and war crime investigations in regions such as Rwanda, Argentina, and the former Yugoslavia (1). The focus for anthropologists in these settings is victim recovery, skeletal trauma assessment, and the process of individualization (2) leading to identification and evidence collection.

Personal identification of unknown human remains resulting from war and natural or mass disasters has been examined previously (3–11). In each region, various military, civilian, and law enforcement agencies are responsible for establishing identity, and each group has its own criteria for verifying identification (12). However, regardless of the overseeing agency, the criteria are all oriented toward establishing identity through the comparison of postmortem records with supporting social data (12).

Traditional methods of establishing personal identification include visual recognition, fingerprinting (13), DNA (4,9), dental records (14,15), and comparison of ante- and postmortem X-rays (16–18), as well as supporting methods such as video superimposition (19). However, in regions with histories of civil unrest and conflict, there is often a significant delay in victim discovery and recovery. Such extended periods of elapsed time result in advanced decomposition of remains, which precludes identification methods involving visual recognition or fingerprinting. Citizens of such regions often have limited access to healthcare. This, coupled with inadequate documentation or destruction of records during wartime, prohibits dental and X-ray comparisons. Finally, prior to 2001 and the work of the International Commission on Missing Persons (20), DNA testing for identification purposes on such a massive scale was considered too costly and required laboratory resources that were not available. Yet the need to identify victims for criminal and humanitarian purposes persists and demands innovative methods.

One identification method has been employed in both Rwanda and the former Yugoslavia with limited success. This method relies on survivors recognizing clothing, documents, or associated artifacts recovered with the victims. Additional support for such tentative identifications is provided by matching features of the individual generated during the postmortem examination (for example, sex, age, and stature) with a demographic profile of the individual obtained from interviews with surviving relatives.

This study will focus on the efforts of local and international agencies tasked with identifying the victims of one tragic event in the former Yugoslavia: the fall of the town of Srebrenica. During the conflict in Bosnia (1992 through 1995), Srebrenica had been declared a United Nations "safe area" (21). Muslim civilians sought refuge in Srebrenica in the belief that the UN peacekeeping forces would protect them. In July 1995, Srebrenica fell to advancing Serb forces and within days more than 7000 Muslim men were missing and presumed dead (21–23).

Since 1996, the local Bosniak Commission for Missing Persons as well as international agencies such as Physicians for Human Rights (PHR), the International Criminal Tribunal for the Former Yugoslavia (ICTY), and the International Commission on Missing Persons (ICMP) have been exhuming mass graves in the region surrounding Srebrenica, believing these graves contain the remains of the missing Muslim men. Anthropologists and other forensic investigators involved in this process are faced with a unique problem: the remains of the individuals recovered from these graves share identical biological profiles. Virtually all are adult males of a single ethnic affinity who share similar causes of death and postmortem intervals.

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Methods

From 1996 to 2000, Physicians for Human Rights (PHR), an American-based non-government agency, spearheaded the efforts to identify victims of the Bosnian conflict. Focusing on the victims of Srebrenica, PHR developed the AnteMortem DataBase Project (AMDB) and the Podrinje Identification Project (PIP) to gather information on the missing persons from that region. Using a questionnaire of more than 225 items, PHR caseworkers interviewed more than 7800 close relatives of the victims, asking each to give a physical description of the individual, as well as their clothing, jewelry, and other personal possessions (24). This antemortem information was entered into the database and was compared to the available postmortem data generated at autopsy. As of December 1999, the computer database had not yet been integrated to any comparable postmortem database and matches were being sought by querying the AMDB on a case-by-case basis. At the time of this study, 63 matches had been finalized and in many cases confirmed by DNA analysis.

This study examines 59 of these successful matches to identify the contributions as well as errors generated by anthropological methods as part of the postmortem examination process. First, the age, sex, and stature estimations were compared to the reported antemortem data to determine overall accuracy and rates of misclassification. Second, the performance of anthropologists in assessing antemortem skeletal trauma, and identifying other unique biological features was evaluated, along with the role these features played in the identification process. Finally, the validity of using third-party reported data in lieu of more traditional antemortem documentation will be discussed.

All data were obtained by the author directly from the PHR case files, which included autopsy reports, the antemortem database questionnaire, consultant notes from follow-up interviews with the victim's family, and PHR case evaluation forms.

Results

Sex assessment of all individuals as male was correct. Of the 59 cases included in the study, the actual age-at-death of 25 individuals (42.4%) fell within the age-range estimate generated during postmortem examination. In cases where the range of the estimate was ten years or less, only 17 individuals (28.8%) matched correctly. Of the 34 individuals who were aged incorrectly, 23 had an age-at-death older than estimated, while eleven were younger than estimated.

Reported ages-at-death in this study ranged from 16 to 71. Younger individuals (ages 16 to 30) were aged more accurately than individuals in the middle (30 to 50 years) and older (50+ years) age ranges (Table 1). Estimated age ranges were smaller (4 to 10 years) for younger individuals than those given to the older cohorts (5 to 20 years).

Stature estimates were generated in 51 of the 59 cases. Of these 51, only 15 (29.4%) had a reported height that fell within the estimated range provided in the postmortem report. Discrepancies between reported and estimated heights ranged from 0.65 to 21.5 cm.

Although positive identification was established by a variety of methods (including DNA and documents recovered), the presence of a unique biological feature played a significant role in establishing identity in eleven cases. A summary of the features is given in Table 2. In three of the eleven cases, the relatives reported a significant AM injury or feature that was not noted in the postmortem findings.

TABLE 1—*Accuracy of age estimation of positively identified individuals, by age cohort.*

Age Cohort, Years	Sample Size	Percent Aged Correctly	Age Range Size
16–30	16	11/16 (68.8%)	4–10 years
30–50	23	11/23 (47.8%)	5–20 years
50+	20	4/20 (20%)	5–20 years

Discussion

The accuracy of sex determination in this study was 100%. Traditional sex estimation methods using visual (25) and metric assessment (26) of pubic bones have reported accuracy rates of 96 and 90%, respectively. However, when evaluating the accuracy of sex assessment, the overrepresentation of males within the sample population cannot be ignored. Of the 7723 missing persons in the PHR antemortem database, only 175 (2.3%) are females.

The distribution of reported ages of the missing individuals is also relevant to assessing the accuracy of age estimation. The less-than-30 and greater-than-50 year old cohorts each account for approximately 28% of the total population of missing persons, respectively. The mid-range age cohort (ages 30 to 50) represents the remaining 43% (see Table 3). Only individuals from the youngest cohort were aged accurately at a percentage significantly greater than chance.

Prior studies on the overall accuracy of various aging techniques argue for a comprehensive approach that utilizes all available evi-

TABLE 2—*Summary of comparisons of antemortem description and autopsy findings regarding unique biological identifiers/features from positively identified individuals.*

Antemortem Description	Postmortem Findings
Left leg, knee amputation	Left limb, below the knee amputation
Mandible FX with wire repair	Mandible FX with wire repair
Left humeral FX	None
FX L leg, L finger	FX L tibia, FX L metacarpal
FX of leg (side unknown)	FX right distal tibia
Tracheotomy tube	Tracheotomy tube
FX right shoulder	FX left humeral shaft
Operation scar on head	Craniotomy defect
Pin in right shoulder	Ortho. Screw neck of right humerus
Arm joint broken	None
Glass eye—right	Not noted in initial autopsy

TABLE 3—*Distribution of reported ages for male individuals in the Physicians for Human Rights Ante Mortem Database.*

Age Cohorts, Years	Number of Individuals, %
<10	19 (0.2)
11–19	85 (1.1)
20–24	1050 (13.6)
25–29	999 (12.9)
30–34	896 (11.6)
35–39	877 (11.4)
40–44	822 (10.6)
45–49	748 (9.7)
50–54	546 (7.1)
55–59	536 (6.9)
60–64	517 (6.7)
65–69	300 (3.9)
70+	328 (4.2)

dence and emphasizes the training and experience of the observer (27,28). While such an approach is deemed optimal, circumstances exist in the Balkans that impede a truly comprehensive evaluation of age for each individual. Primary constraints include time and access to equipment. Attempting to complete comprehensive postmortem examinations of thousands of individuals within a reasonable timeframe precludes more labor-intensive methods such as histological osteon counts (29,30). Lack of access to the necessary preparatory and laboratory equipment also eliminates consistent use of microscopic methods of age assessment.

Further challenges arise when evaluating the experience or training of the anthropologists performing the methods. Inherent in multinational human rights investigation is the participation of experts from around the world. Such diversity provides an unprecedented opportunity for the exchange of information and methodologies. It may also result in inconsistencies in levels of training or expertise, differential access to literature or equipment, and language barriers effecting communication and translations of autopsy reports. Furthermore, the application of standards derived from North American skeletal samples to European contexts may have contributed to the error rate reported in this study.

A final constraint comes from the condition of the remains. Prolonged postmortem intervals, extensive perimortem trauma as well as postmortem modifications such as burning, multiple reinternments, or disturbances of the graves (31) result in poor element survival rates. As most aging methods are based on evaluating specific elements, many methods may be eliminated due to issues of preservation. This differential availability of elements may necessitate some anthropologists resorting to unfamiliar aging methods.

Of all the osteobiographic variables reviewed in this study, the least accurate and informative is stature estimation. Estimating stature proves problematic due to a number of factors. First, consideration must be given to the accuracy of the antemortem reported statures. Bias in self-reporting of stature has been well documented (32–34). Problems in the perception of stature by others have also been addressed previously (35). Confounding the issue further is how antemortem stature values are derived. Living height is established during the course of an interview between the caseworker completing the questionnaire and the family member of the missing individual. The caseworker may ask, "Was your loved one as tall as me?" The family member would then offer adjustments, and a final estimate of the proposed height is recorded by the caseworker (35, personal observation). The accuracy of any stature estimate becomes moot when it is to be compared to such questionable AM data. A further consideration becomes evident when examining the antemortem statures provided for all individuals in the PHR AMBD (Table 4). A total of 79% of the reported heights for all males included in the database falls between 173 and 189 cm. This indicates that the only true value of stature estimates comes from categorizing those of extremely great or small stature (35).

Second, another factor challenging the veracity of stature estimates is the use of standards and regression formulae generated from non-European populations. Ross and Konigsberg (36) found that the Trotter and Gleser stature formula for White males consistently underestimated the height of Eastern Europeans and was unsuitable for populations in the former Yugoslavia.

Anthropologists are tasked not only with generating osteobiographies but also individualization. This process focuses on identifying unique biological features such as AM fractures or other skeletal pathologies, evidence of surgical interventions, or dental anomalies and modifications. Of the 59 case files reviewed, eleven indicated that a unique biological feature contributed to establishing identity. The use of these features is not without problems, however. Of paramount importance is the assumption of the "uniqueness" of these characteristics. No literature exists detailing the frequencies of these biological features in modern populations, much less data specific to the former Yugoslavia. It is not currently known whether a fracture to the distal left tibia is sufficiently rare as to be deemed unique. Nor is it known how such features vary by sex, age, socio-economic status, or geographic location.

TABLE 4—*Distribution of reported height estimates for males in the Physicians for Human Rights Ante Mortem Database.*

Height, cm	Number of Individuals, %
<150	77 (1.0)
150–157	11 (0.2)
158–160	17 (0.2)
161–164	226 (3.0)
165–172	521 (6.9)
173–176	1412 (18.8)
177–179	1648 (21.9)
180–184	1951 (26.0)
185–189	912 (12.1)
190–194	423 (5.6)
195+	127 (1.7)
Unknown	191 (2.5)

This uncertainty is compounded by the quality of the antemortem data obtained from family members. Gathering medical information from relatives with little or no medical background results in understandably nonspecific descriptions of past ailments. A reported fracture to the leg (side unknown) was ultimately matched to an individual whose postmortem examination revealed evidence of a fracture to the right distal tibia. Even the issue of siding is challenged, as in the case of a family reporting a fracture to the right shoulder that was matched to an individual with a fracture of the left humeral shaft (see Table 2).

Assessing the performance of the anthropologists in this setting becomes difficult. In two cases summarized in Table 2, AM descriptions were given for a left humeral fracture and a broken arm joint. In neither case was any evidence of these injuries noted during the postmortem examination. Are these discrepancies the result of inaccurate or ambiguous information from the families or a failure on the part of the investigators performing the postmortem examination to identify prior injury? In only one case is the answer clear. One individual was identified based on the presence of a glass eye, a feature overlooked during the initial autopsy but found in a subsequent examination. It is important to note, however, that the conditions in which the anthropologists and pathologists conduct postmortem examinations in the former Yugoslavia are often challenging. Efforts to perform thorough autopsies are sometimes confounded by a lack of equipment such as X-rays or Stryker saws as well as a lack of facilities or time to fully deflesh and prepare skeletal remains. Perceived errors or shortcomings in the process are likely a result of deficiencies in the infrastructure available to investigators, rather than the expertise of the investigators themselves.

It is also impossible to assess the contributions and limitations of anthropologists participating in the identification process without addressing the validity of using third-party reported information as the supporting AM social data. Truly meaningful evaluations of accuracy are derived through the comparison of the estimate or unknown variable with a known or fixed variable. While it is

possible to argue that variables such as sex and age can be obtained as reliably from family members as from documentation, information on characteristics such as stature, dental modifications, or pathologies are inevitably suspect or ambiguous. The question remains whether such data are an acceptable or viable alternative when faced with the complete absence of more traditional sources of AM information.

Conclusions

In the interest of fairness to all the anthropologists who participated in the postmortem examination and identification processes described in this report, it is important to differentiate methodological weaknesses from anthropologist error or inexperience. The majority of the inaccuracies or errors generated in the osteological analyses of Bosnian conflict victims stem from: (1) the use of standards that were created on North American samples and have not been adequately tested on Eastern European populations; (2) inadequacies in osteological methods; (3) constraints imposed by time, resources, or facilities; and 4) ambiguities inherent in third-party reported AM data. Research-generating population-specific standards of sex, age, and stature estimation is clearly warranted.

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