Strengthening the role of forensic anthropology in personal identification: Position statement by the Board of the Forensic Anthropology Society of Europe (FASE)

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ABSTRACT

In this position statement, the Board members of the Forensic Anthropology Society of Europe (FASE) argue that forensic anthropology methods can be used as means of personal identification, particularly in situations with limited availability of traditional identification methods (i.e. dactyloscopy, odontology, and molecular genetic analysis). This statement has been issued taking into account the international migration crises related to thousands of deaths worldwide, in which the utility of these traditional means of identification has been sporadic to non-existent. The statement is however not limited to deaths related to the migration crises, as similar problems may occur in fatalities *en masse* such as in natural disasters and armed conflicts, and on a smaller scale in cases of homeless or otherwise socioeconomically disadvantaged persons. The number of reports on personal identification based on sound anthropological methodology is increasing in the scientific literature. However, more research is needed to develop evidence-based standard operating procedures and statistical frameworks. It remains essential to raise awareness among forensic practitioners, law enforcement, and judiciary professionals on the utility of forensic anthropology in cases where it can provide sufficient information for identification.

1. Introduction

Identification of the deceased is a pivotal step in almost any procedure related to the resolution in the death of a person including legal proceedings pertaining to a person's death, either criminal (e.g. investigation of murder, abuse or torture) or civil (e.g.

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inheritance, marriage or child custody). Equally important is the identification of the deceased for the psychological well-being of the family. There is an emerging body of literature referring to "ambiguous loss" and the significant mental health issues caused by the uncertainty and the inability to mourn and find closure until the status of the missing person is known [1,2]. The legal and humanitarian importance of identification is illustrated by the fact that an individual's right to identity has been adopted in international humanitarian law [3] and international human rights instruments such as the Universal Declaration of Human Rights [4].

The Forensic Anthropology Society of Europe (FASE) argues that properly applied forensic anthropology methods can be used for identification, especially in situations with limited applicability of traditional methods (i.e. dactyloscopy, odontology, and molecular genetic analysis) resulting from lack of preservation, and/or unavailability of an antemortem reference samples, often due to reasons related to difficult social, economic or political conditions of some countries or individuals, which may also preclude that close relatives are not readily available. This paper aims to emphasize the role of forensic anthropology in identification in challenging circumstances.

2. Means of identification

Positive identification by forensic means is legally binding, and is based on the comparison of antemortem (AM) information of a missing person with the findings of the postmortem (PM) examination of an unidentified individual. Positive identification is established when the AM and PM data are concordant, with no unexplainable differences (to the exclusion of all other reasonable possibilities), and with sufficient evidentiary value that they relate to the same individual.

How the identity of a decedent is established is the prerogative of the local jurisdiction. Local jurisdictions utilize different approaches in the resolution of unidentified decedents. The Interpol Guide for Disaster Victim Identification (DVI), first published in 1984 and last updated in 2018 [5], has been widely adopted as a guide in the management of the identification process for legal and medical professionals in mass fatalities. The Interpol guide has traditionally distinguished between primary and secondary identifiers. Primary identifiers are considered 'the most reliable methods by which identification can be confirmed' [6]. Currently, Interpol's list of primary identification sources includes fingerprints, DNA, dental comparisons, and medical/surgical implants with unique serial numbers. Secondary identifiers are all other types of evidence that contribute to personal identification including personal descriptors, AM medical findings, tattoos, and other circumstantial evidence such as clothing and personal belongings found on the body. These secondary identifiers support the conclusions about identity but are "ordinarily not sufficient as a sole means of identification (although depending on the circumstances, there may be some exceptions)."

3. Challenges in identification

In mass deaths such as large-scale natural disasters, armed conflicts, and the current international migration crises, the feasibility of the primary means of identification may be unrealistic or non-existent. The use of primary (according to Interpol) identification methods may be inapplicable because there is no "primary" AM comparative data available or the PM examination does not yield the necessary biological information. This is, for instance, the case in large numbers of undocumented border crosser deaths (Fig. 1). A similar situation may occur on a smaller scale in cases of individual migrants, homeless or otherwise socioeconomically disadvantaged persons with no known next of kin.

Even though DNA can be found in any human cell, fingerprints are almost universally available in non-mutilated bodies, and dental restorations are common in developed countries, the PM collection of this information depends heavily on the state of preservation of the remains. Primary identifiers may thus be unavailable in skeletonized, burned, fragmented, commingled, decomposed or otherwise unidentifiable remains [8,9]. In addition, unknown or unidentified remains are regularly not fully examined using standard forensic methods due to the misconception that DNA will ultimately solve the case.

The availability of AM information and thus the feasibility of the different means of identification seem to be more or less related to

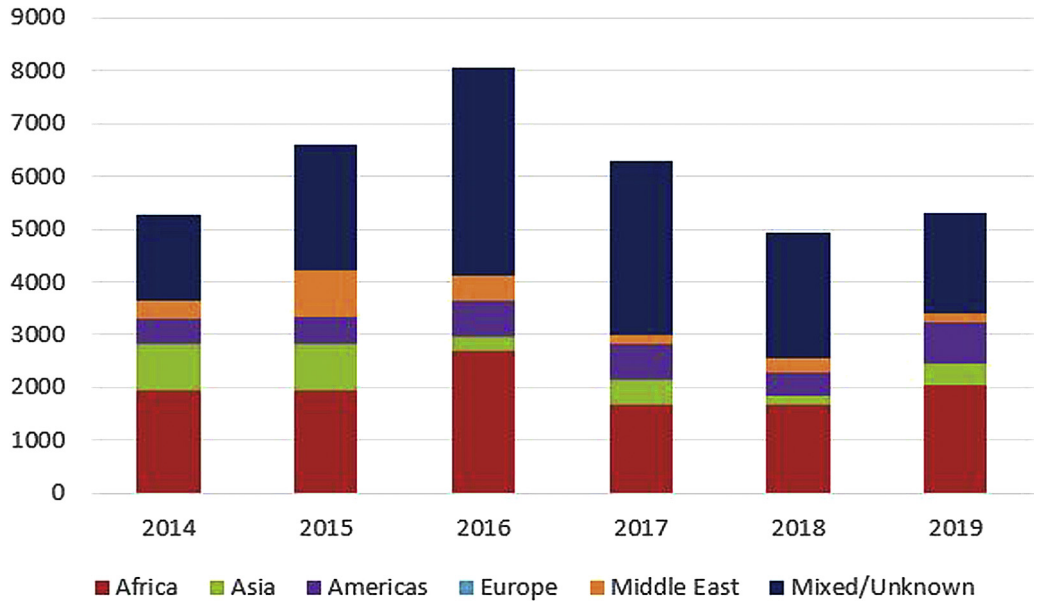

Fig. 1. Recorded migrant deaths by region of origin, adapted from the International Organization for Migration Missing Migrants Project [7].

the socio-economic status of the country. In many developed countries, identification is undertaken almost exclusively via dental or DNA comparisons due to a proactive collection of samples and easily accessible national databases of dental records or fingerprints. Still, it must be kept in mind that even within the European Union, there are countries where it is nearly impossible to obtain AM information from dental or medical records. For example, serial numbers of surgical implants are not always easy to follow up especially when surgery was performed a long time before or performed in a different country than the recovery of the remains or when the surgical companies that produced them no longer exist [10].

The difficulty of obtaining AM data on primary identification parameters was also encountered in the aftermath of the 2004 Indian Ocean Earthquake and Tsunami, Hurricane Katrina, and the Haiti earthquake [11–13]. In these disasters, the usual sources of comparative AM data such as fingerprints and/or dental/medical records became inaccessible due to the destruction of the local infrastructure. The lack of official governmental databases and medical records has also been mentioned as a restriction for the identification process in several investigations of mass casualties following armed conflicts [14–18].

In case of DNA, AM information is frequently obtained by taking DNA samples of personal belongings of the missing person provided by family members. Alternatively, comparative DNA samples may also be obtained from close blood relatives. This poses a problem when personal belongings become unavailable and several members of one family are among the dead or impossible to contact. Such a situation was for instance encountered after Hurricane Katrina when in many cases the direct sources of DNA (homes with personal effects) and familial DNA of close relatives were unavailable. When comparative DNA material is provided by cousins or half-siblings rather than close blood relatives, the comparisons may become complex and the results may be insufficient for an identification [19,20].

An efficient collection of AM data requires an up-to-date and complete list of missing persons. In any disaster, the collation of such a list is challenging. In open, multinational, protracted, and large-scale disasters obtaining even the most basic information on the missing may prove extremely difficult if not impossible. With limited knowledge about the country of origin of the deceased, finding relatives of the decedent or accessing national registries and databases for AM information in a timely manner is nearly impossible.

According to the Deaths at the Borders Database [21], which summarized the identification status of migrants, who died while attempting to reach five southern EU countries (Italy, Malta, Spain, Gibraltar and Greece) and were documented by the local authorities between 1990 and 2013, 63% remained unidentified (Fig. 2 showing data on identification status from 2004 to 2013).

Taking the above-mentioned challenges into account, primary identifiers cannot always be used to render an identification. At the same time, some of Interpol's secondary identifiers, particularly forensic anthropological approaches, may provide critical information for the identification of the decedent, or even may have sufficient evidentiary value for a conclusive positive identification provided the scientific approach is sound and reliable. Given that the usefulness of an identifier is highly dependent on the context of the case (e.g. [22–25]) a division between primary and secondary identifiers seems inappropriate. We therefore suggest referring to all types of evidence in relation to identification simply as identifiers, and when necessary refer to the particular substrate or methodology, such as molecular genetic or odontological analysis.

4. Anthropological identifiers

Forensic anthropological identifiers encompass external morphological and skeletal features of the human body. The external features include the morphological features of the face, teeth, and other body parts, and skin alterations (such as scars and moles). The skeletal features include the morphology of individual skeletal elements and structures such as frontal sinus patterns, trabecular bone pattern, anatomical variants, developmental anomalies, pathological changes (e.g. due to disease or trauma), and medical interventions.

The analysis of external features can be undertaken analogously to the established guidelines for facial image comparisons relating

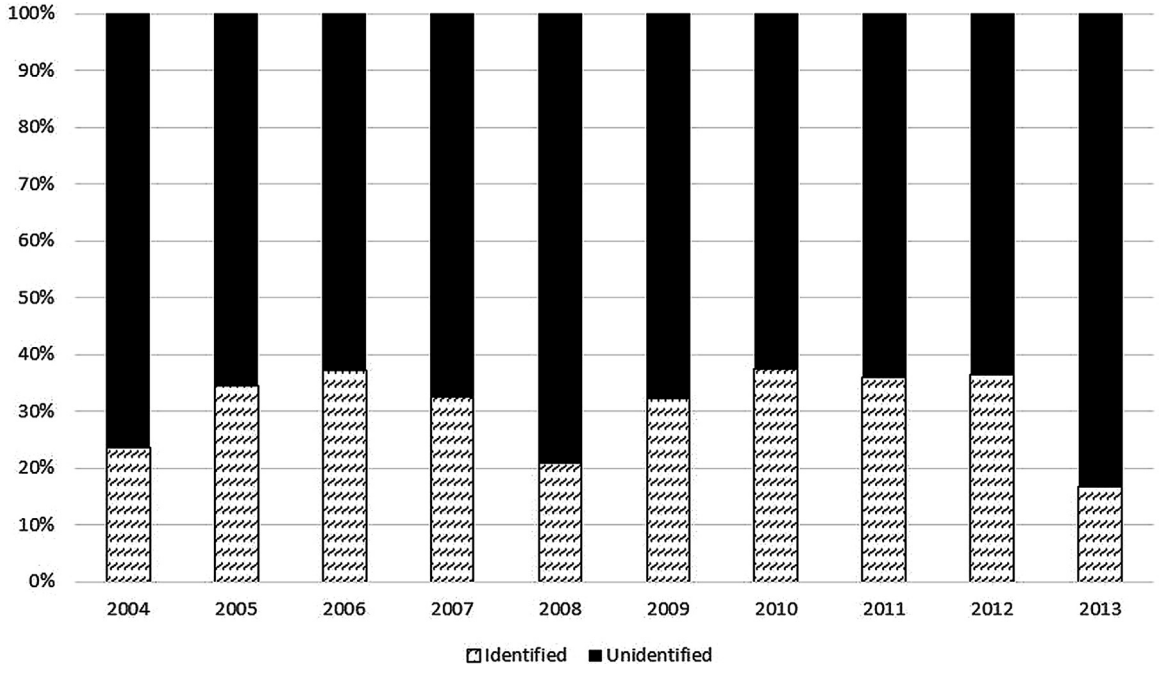

Fig. 2. Identification status of migrants to five southern EU countries as recorded in the Deaths at the Borders Database [21].

to the living [26]. Assessment of morphological characteristics (i.e. form and location), including facial features and skin changes, which can be analysed according to the methodology of facial image comparison, falls within the competence of forensic anthropologists. Forensic anthropologists in many European countries act as expert witnesses in facial image comparison, and are often employed as experts in this area.

Photographs of missing persons are often provided by relatives and friends or are sourced from social media. By applying the methodology of facial image comparison, antemortem photographs and videos depicting the missing can then be compared to PM documentation, either as multi-perspective high-resolution photographs or 3D reconstructions from CT- or surface scans [26–33].

Due to technological advances in, and the increased availability of (medical) imaging techniques, the description, assessment, and comparison of morphological features and structures has become increasingly relevant in the context of personal identification. Medical radiographs and scans, as well as digital photographs and videos, provide novel sources of both AM and PM information. Postmortem medical imaging and digital photography/3D scanning, can – if available – be compared to AM information. One of the other major advantages of PM documentation by imaging is that the images can be stored indefinitely, as opposed to the remains or bodies which are usually buried and often cremated after a certain period of time. In addition, the acquired images can be shared with relative ease across agencies and borders to facilitate identification when comparative AM data do become available. Recent forensic literature illustrates how imaging of anatomical and pathological features of the human body can facilitate identification (Table 1).

5. The use of anthropological identifiers in mass disasters

It is a popular misconception that the Interpol DVI Guide precludes an identification that is not based on molecular genetic analysis, odontology or dactyloscopy. In fact, the Interpol Guide explicitly acknowledges the use of other means of identification stating that "*secondary identifying features have been regarded as secondary in quality whereas this is a temporal definition. Whilst primary identifiers may each individually, or in combination, provide rapid and reliable identification of the deceased, secondary identifiers tend to be used when primary identifiers have failed to secure a verifiable identification. Secondary identifiers in combination may provide sufficient information to make identification in selected cases, and where access to primary identifiers may be limited or absent they may be the only means whereby the deceased can be identified.*" [6; p. 95]. The Interpol Guide also states that " . . . fingerprints, dental records, DNA analysis, and medical data are of great use in positive victim identification, but of potentially equal importance is other information provided by anatomical features, tattoos, etc. Depending on the nature of the disaster, the condition of the body and available AM data, forensic experts will use the techniques best suited to the given situation." [61]

Other national and international guidelines also acknowledge morphological comparison as a principal means of identification. According to the WHO/ICRC, highly discriminating means of identification also include unique physical or medical traits, including skeletal radiographs and numbered surgical implants [62]. The definition of 'highly discriminating scientific means of identification' is "conclusive to a degree that would be considered beyond a reasonable doubt in most legal contexts." (Ibid.). Similarly, the U.S. National Institute of Justice accepts dactyloscopy, forensic odontology, radiology, molecular genetic analysis, and forensic anthropology as sufficient proof ('confirmatory') of identity in mass disasters [63].

Consequently, there are several examples of DVI operations in which the majority of the identifications were based on methods other than Interpol's primary identifiers. The Japanese DVI team reported that following the Tsunami in 2011, 89% of the 15,736 victims were identified based on personal belongings or visual recognition [64], although 'most bodies were not injured or decomposed'. In the aftermath of the Thailand Tsunami in 2004, approximately one in three victims was identified by physical appearance [65]. It must be stressed here that visual recognition is not equal to identification, which may be achieved, for instance, by the scientific methodology outlined in the practice of facial image comparison [26]. Recognition is an innate cognitive process and is by no means a scientific method, hence it does not conform to the rules and recommendations for forensic practice or court admissibility.

Wright et al. [12] described how physical characteristics were applied in the identification process after the Thailand Tsunami in the "near identification-threshold" cases, for which DNA comparisons provided not sufficient certainty for identification. Twenty-two of the victims of the Lampedusa shipwreck in the Mediterranean Sea in 2013, were identified by a combination of non-genetic (including anthropological) and genetic methods or by non-genetic methods alone [66]. Komar and Lathrop [18] noted that morphological features, including AM traumatic and pathological skeletal changes, surgical interventions, identification documents or unusual clothing and personal effects were used to identify the victims of the Former Yugoslavian conflict. Presumptive identifications of the victims in a mass grave in Bihać in Bosnia were made based on biological profile parameters and clothing and approved by the local authorities and victim's family (A. Ross, pers. comm.). Similarly, Šlaus et al. [16] observed that of the human remains recovered from different types of mass graves in the aftermath of the Croatian War only about 18% were identified by molecular genetic analysis, whilst more than 50% were identified by a combination of "biological and non-biological features". In this respect, we would like to emphasize that the role of forensic anthropologists and pathologists in identification cases is to present and interpret the biological data only. It is the domain

Table 1
Selection of published precedent forensic cases of personal identification based on anthropological (both anatomical and pathological) features of the human body.

Anthropological identifier	Type of imaging	References
Anatomical variants/Bone shape	Conventional radiographs, CT-scans, 3D-reconstructions	[34–42]
Frontal sinuses	Radiographs, CT scans, 3D reconstructions	[43–46]
Pathological changes	Conventional radiographs	[47–50]
Medical devices	Conventional radiographs	[10,51–53]
Dental morphology	Photographs (smiling), 3D surface scans and reconstructions	[27,28,32,54]
Morphology of the face and other body parts	Photographs	[30,31,33,55,56]
Moles	Photographs	[57,58]
Scars	Photographs	[59,60]

of law enforcement, magistrates or other forensic actors to present and interpret the non-biological features, such as clothing or identification documents (even if found on the body).

6. The way forward for identification by forensic anthropological means

Molecular genetic analysis, dactyloscopy, and odontology have in the past benefited from targeted research and a long forensic tradition. As a consequence, the collection, analysis, and interpretation of AM and PM data for these traditional identification methods are well-established. Other identification methods need to meet similar standards in terms of data management and evaluation of evidential value when used for identification.

Recently, several initiatives in the Mediterranean countries (e.g. Italy) and also at the US-Mexican border have been developed to facilitate the use of anthropological methods by creating functional networks, providing training, and establishing protocols for data collection [66–68]. These protocols include, among others, comprehensive imaging (e.g. photographs, 3D scans, and radiographs) and detailed descriptions of soft tissue (if available) and skeletal anatomical and pathological features as well as artificial modifications. Similarly, in South Africa, a collaboration was set up between the ICRC, the South African Police Services and Forensic Pathology Services (Johannesburg) to systematically collect PM data of unknown deceased individuals [69,70] and AM data concerning the missing. The PM data collection is based on the Interpol guidelines, but has been adjusted for the South African situation and includes photography and collection of other potentially identifying information. Through the assistance of the ICRC, these are matched with information obtained from relatives of deceased individuals in other southern African countries. To date, a number of positive identifications have been made based mostly on fingerprints and visual identification.

Postmortem computed tomography is increasingly being employed by forensic pathology units in Europe and worldwide; the virtual databases providing a source of contemporary skeletal reference samples [71–76]. Although training is needed to extract and utilize 3D skeletal models, these databases provide a wealth of information comparable to dry bone collections in addition to a fast exchange of the digital data.

One of the limitations of the use of anthropological identifiers is the limited number of studies and case reports presenting relevant statistical frameworks for the interpretation of the findings (e.g. discussed in [22,77–79]). This apparent shortcoming is also an often overlooked issue in forensic odontology.

Future research should focus on assembling and sharing large scale reference databases, and the provision of a framework for the analysis, interpretation and presentation of the evidential value of anthropological findings [80].

Another way forward is the exploration of interdisciplinary approaches for identification purposes, as shown by emerging publications concerning the use of stable isotope analysis in forensic anthropology for narrowing down of the provenance of human remains, and thus helping search for antemortem data [81–85].

7. Conclusion

The members of the FASE Board argue that methods of forensic anthropology can be used as a means of identification, particularly in situations when primary identifying features are not applicable. Contrary to the common belief, this position statement is in agreement with the updated Interpol Guide, which does not preclude anthropological findings as a means for identification. In the past, anthropological identifiers have been used for personal identification both in individual cases of unknown decedents and in mass disaster settings, including natural disasters and armed conflicts. Morphological comparisons of the physical appearance (mainly faces and dentitions), pathological and traumatic lesions and signs of medical interventions were among the approaches used for identification. Although there is still room for improvement in the methodology, including the establishment of evidence-based protocols and statistical frameworks, FASE Board members believe that anthropological identifiers are applicable under field conditions, are time-effective and reliable, and may provide accurate results similar to the traditional identification methods, and thus can be used for a conclusive identification. Meanwhile, the requests for probability statements in the presentation and interpretation of anthropological findings in identification cases can be informed by recommendations published in documents on feature-comparison methods, such as fingerprints, side-by-side radiographic comparisons, and tool-mark analyses [42,86–88].

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Hans H. de Boer: Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **Zuzana Obertová:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Visualization. **Eugenia Cunha:** Conceptualization, Writing - review & editing, Supervision. **Pascal Adalian:** Conceptualization, Writing - review & editing. **Eric Baccino:** Conceptualization, Writing - review & editing. **Tony Fracasso:** Conceptualization, Writing - review & editing. **Elena Kranioti:** Conceptualization, Writing - review & editing. **Philippe Lefévre:** Conceptualization, Writing - review & editing. **Niels Lynnerup:** Conceptualization, Writing - review & editing. **Anja Petaros:** Conceptualization, Writing - review & editing. **Ann Ross:** Conceptualization, Writing - review & editing. **Maryna Steyn:** Conceptualization, Writing - review & editing. **Cristina Cattaneo:** Conceptualization, Writing - review & editing, Supervision.

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