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## **Forensic Anthropology in Disaster Victim Identification: Best Practice Recommendations for the Medicolegal Authority**



**DRAFT DOCUMENT**

# **Forensic Anthropology in Disaster Victim Identification: Best Practice Recommendations for the Medicolegal Authority**

## **1 Forward**

In a disaster victim identification (DVI) operation, the forensic anthropologist will employ the most appropriate forensic anthropological techniques in a reliable, objective, and timely manner in order to efficiently recover, describe, analyse, and interpret human biological tissues. These efforts will aid in an effective and efficient recovery effort, informative inventory of skeletal tissue represented, and documentation of skeletal features that may lead to positive identification. DVI operations are most effective when using a multi-disciplinary approach that includes principles, methods, and techniques from the field of forensic anthropology. Forensic anthropologists often perform a number of roles in the DVI process. These roles include the initial sorting of human from non-biological and non-human remains; inventories of skeletal and anatomical structures present; estimation of chronological age at death, sex, ancestry, and stature; the recognition of skeletal features that may facilitate identification; and preliminary interpretations of skeletal trauma patterns and timing. This information can often be obtained regardless of state of preservation (e.g., complete, fragmented, commingled, or taphonomically-modified). Further, most of these determinations can be made effectively and efficiently by simple gross examination and/or using high-quality radiographs.

These best practices are put forth by the Disaster Victim Identification subcommittee within OSAC. This document originated from the Scientific Working Group on Disaster Victim Identification (SWGdVI).

## **2 Acknowledgements**

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## 4 Scope

The descriptions herein provide guidelines and best practices relevant to the role of forensic anthropology in a DVI operation. Anthropological methods, techniques and principles are typically employed in five primary capacities: 1) during the *Preplanning* phase of a DVI operation, 2) the *Search and Recovery* and preservation of remains from a mass fatality incident, 3) at the *Triage Station* during the initial sorting of material gathered from the field and determination of what human tissue enters the morgue, 4) at the *Anthropology Station* collecting quality postmortem data from each morgue sample, and 5) as a member of the *ID Reconciliation Team*, focused on ensuring valid and reliable positive identifications from human tissues. Focus in this document will be primarily on the *Triage Station* and the *Anthropology Station*. Additional guidelines pertaining to *Preplanning*, *Recovery*, and the *ID Reconciliation Team* can be found elsewhere in the OSAC DVI Subcommittee guidelines. DVI practitioners should adhere to the best practices identified in this document to the extent possible, practical, and appropriate. In the absence of specific guidelines, the principle, spirit, and intent of these guidelines should be met.

## 5 Terms and Definitions

### 5.1 Forensic Anthropology

Forensic Anthropology is the application of anthropological methods and theory - particularly those relating to the recovery and analysis of human remains - to resolve legal matters.

## 6 Recommendations

### 6.1 Preplanning

Planning for mass fatality responses is typically the responsibility of mass fatality management systems specific to a geographic or jurisdictional area. Anthropologists should be cognizant of, and contribute to, the planning, implementation and management of the entire response process in order to effectively integrate an appropriate forensic anthropology response with other DVI professionals and facilitate timely and accurate identifications.

### 6.2 Search and Recovery

Most forensic anthropologists have a broad skill set and training in archaeological methodologies. It is highly recommended to include an anthropologist during the entire recovery process to not only maximize recovery/preservation of human remains but to also maintain the integrity of the provenience/context, which may speed the identification process and reduce cost. Constant communication between the field and the laboratory/morgue is essential to fully exploit the efforts performed by both functions. The DVI Subcommittee Mass Fatality Scene Processing document will address guidelines and best practices for the search and recovery process.

### 6.3 Triage

Initial sorting of tissues and other evidence gathered in the field occurs at the Triage Station. It is here that material collected during the search and recovery operation is examined and sorted prior to entering the disaster morgue. Recovered material potentially includes: commingled human

tissue; personal effects; vehicle components; animal and plant material; and other unsorted material. The goal of the Triage Station is to segregate all tissue and eliminate commingling of individuals in order not to miss a potential identification. This is achieved by separating out all human tissue not attached via a tissue bridge and segregating all human tissue from non-human tissue, unassociated personal effects, and any other non-biological evidence.

Immediately following triage activities, all human tissue that will enter the morgue must be assigned a unique morgue reference (or specimen) number. This most often occurs at the adjacent Admitting Station, or in some situations may be part of the duties of the Triage Station. Personal effects still directly associated with the human tissue will also enter the morgue, to be separated later in the Pathology Station or the Personal Effects Station. In most systems, all other dissociated material and debris is documented, removed, placed in the custody of law enforcement, or discarded, but does not enter the disaster morgue. In some systems all human and non-human tissue are processed through the disaster morgue, to ensure accountability and analyses of all specimens and to facilitate radiographic examination.

### **6.3.1 Location of Triage Station in Disaster Morgue Configuration**

The Triage Station is located at the entrance of the disaster morgue. After the biological tissue evidence (including that which is directly associated with non-biological materials, such as personal effects), is properly documented in the field (see Search and Recovery), it is taken first to the Triage Station.

### **6.3.2 Triage Station Personnel**

The Triage Station should be staffed by a multidisciplinary team composed of forensic anthropologists, forensic pathologists, and in some cases, law enforcement officials. It is critical that the team includes individuals who:

- can distinguish human from non-biological materials (including those that may mimic the appearance of human remains);
- can distinguish human from non-human tissues, particularly skeletal (osseous and dental) tissues;
- are experienced with fragmented bone and soft tissue; and
- have experience with heat-altered (i.e., burned) or otherwise compromised remains.

Trained and experienced forensic anthropologists are considered ideal candidates. Triage station personnel should be familiar with the DNA analytical protocols that will be used in the DVI process. Law enforcement officials should be assigned to the station, or have their own Evidence Station associated with the Triage Station, in order to take possession of unassociated personal effects. Consideration of the specific incident may also indicate which other experts (e.g., an explosives expert) may be necessary to assess evidence.

### **6.3.3 Triage Station Activities**

Photography of all specimens may occur as they enter the triage process for accountability and evidentiary purposes.

All material from each field specimen container is taken out of the containers and sorted at the Triage tables.

In most circumstances, commingled human tissue will be separated into discrete units.

As appropriate, specimens from the same field recovery container may be associated with each other via fracture-matching or bone conjoining efforts. While this re-association may not generate an identification, it potentially reduces the number of specimens that need to be sampled for DNA analyses and simplifies the identification process.

Personal effects directly associated with the human tissue, including jewelry, clothing, and objects in clothing pockets will not be disassociated from the human tissue at the Triage Station. This will occur at the Pathology Station or the Personal Effects Station.

Personal effects not directly associated with human tissue will be separated and will not enter the morgue. Typically, this material is taken into custody by law enforcement.

Any biological tissue of non-human animals that may be associated with the mass fatality incident and potentially considered as a pet may be separated and sent to the Anthropology Station for analysis and confirmation of non-human animal remains.

Evidence not significant to DVI operations, such as vehicle components, will be separated and will not enter the morgue. Typically, this material will be taken into custody by law enforcement or other investigative agencies.

Non-significant evidence in the form of non-human animal (non-pet) and plant remains associated with biological tissues will be discarded, while accounting for the field specimen number, if necessary.

After sorting at the Triage Station, the materials to be processed through the disaster morgue should be placed into clean individual containers/bags, still associated with the field specimen number. A unique morgue number will next be assigned. This can occur in some models at the next (adjacent) morgue station, the Admitting Station, or can occur within the Triage Station in other models.

#### **6.4 Anthropology Station**

The primary role of the Anthropology Station is to provide a rapid and succinct inventory of the human tissue, an assessment of the biological profile, and the notation of features that may be useful for identification. In special cases, a detailed assessment of taphonomic issues, including those related to the timing of trauma, may be undertaken. The assessments must be conducted in a timely manner in order to avoid a bottleneck in the morgue flow.

The forensic anthropological analysis conducted in the disaster morgue at the Anthropology Station is based on validated methods and techniques used in day-to-day forensic anthropology work (such as those promulgated by the OSAC Anthropology Subcommittee. However, the scope and scale of anthropology analyses conducted should be consistent with the objectives and constraints associated with the DVI process. Due to time and logistical constraints in most DVI scenarios, analyses at the Anthropology Station are typically more limited. Assessments must be made in a timely manner and according to accepted discipline standards. Anthropologists employed in the disaster morgue should recognize these constraints and work within the framework established by the management of a particular response.

##### **6.4.1 Location of the Anthropology Station in the Disaster Morgue Configuration**

Disaster morgue specimens should enter the Anthropology Station only after documentation in Photography and Radiology has been completed. It is particularly important that quality radiographs of the tissues be available at the Anthropology Station, as many of the anthropological analyses and interpretations can be based on radiographic analysis.

The Anthropology Station is typically located in the vicinity of the Pathology Station in order to facilitate discussion of tissues if necessary. In most cases, human tissue will enter the Pathology Station for documentation and analysis before entering the Anthropology Station, especially when the remains are more complete, if personal effects are associated with the tissue, or if some modification of the soft tissue, such as those involved in a medicolegal autopsy, is required. If the remains are more fragmentary, there may be more flexibility in the order in which the remains are processed in the Pathology and Anthropology Stations.

#### **6.4.2 Anthropology Station Personnel**

The primary personnel at the Anthropology Station include trained forensic anthropologists who have experience dealing with fragmentary, commingled and taphonomically-altered remains, especially, heat and fire-altered bones, and scribes who preferably have a physical anthropology or forensic anthropology background and are familiar with forensic anthropology terminology. Qualifications of the forensic anthropologist should adhere to the guidelines set forth by the OSAC Anthropology Subcommittee.

#### **6.4.3 Anthropology Station Activities**

The primary goal of the Anthropology Station is to collect postmortem data from the bone tissue present in each morgue specimen. This data will include an inventory of bone present, assessment of biological profile, and notation of skeletal features that may provide positive identification. Inventories and assessments must be accomplished in an efficient and timely manner. In most cases, analysis of a high-quality, anatomically-oriented, postmortem radiographic image associated with the specimen will provide significant and informative data required for these assessments. In most cases, removal of soft tissue is not necessary. However, there may be circumstances, for example when a prosthetic device is imbedded in bone, in which some removal of soft tissue is warranted.

It is recommended that a standardized data collection form, preferably in digital format, be used for the collection of the postmortem data.

The first step of the examination is to determine that only one discrete human tissue specimen is present. If human remains are commingled and additional discrete human tissue samples are present, they are sent back to the Triage Station for a new unique disaster morgue number and go back to the beginning of the morgue documentation process.

##### **6.4.3.1 Descriptions of the Human Tissue**

Description of the human tissue will include the bone(s) present, portion of bone represented, side, and other features that may be useful for identification.

A review of the radiograph associated with the specimen is generally all that is required.

However, consistency between the radiograph and the specimen should be verified. Manual palpation may assist in determinations. Cleaning of tissue is generally not necessary, and should be minimal, for example, when using a toothbrush to clean an area.

Only a brief description of the bone portion (e.g., distal  $\frac{1}{4}$  of right humerus) is typically necessary.

Notation is made on standardized data collection forms of skeletal features identified on the postmortem radiographs that may be useful for identification. An initial tentative categorization of the feature (e.g., healed trauma, pathology, or specific skeletal feature) can also be provided.

##### **6.4.3.2 Estimation of Age-at-Death**

Estimation of age-at-death should adhere to the guidelines set forth by the OSAC Anthropology Subcommittee. Assignment to general age categories provides the most effective and efficient means to provide estimates of chronological age at death in material that is highly fragmented: e.g., juveniles (less than 10 years, 10-20 years) and adults (young, middle and older adult). If the remains are more complete, a more refined estimate may be inferred, especially in juveniles.

In more complete remains, multiple areas of the skeleton can be assessed.

Analysis of the radiograph associated with the human tissue will provide most of the information necessary for estimations of age at death. Radiographic analysis will typically

focus on dental development, epiphyseal fusion patterns, location and extent of vertebral body lipping, evidence of joint lipping, chest plate ossification patterns, and other established aging methodologies that can be assessed radiographically.

In most cases, it is not necessary to remove the soft tissue from the bones, (e.g., to study the pubic symphysis or the auricular surface of the ilium) since the probative value contributing to a positive identification will likely be minimal.

#### **6.4.3.3 Assessment of Sex**

Sex assessment should adhere to the guidelines set forth by the OSAC Anthropology Subcommittee. Sex assessment can be performed from the analysis of the postmortem radiograph associated with the morgue specimen. In some cases, limited soft tissue can be removed to take measurements.

In more complete remains, multiple areas of the skeleton can be assessed.

Focus will be on general size and robusticity of the specimen.

Some secondary sexual characteristics (e.g., greater sciatic notch) can be used to assess sex.

A few standard measurements (e.g., femoral head diameter) may be obtained after limited soft tissue removal or even taken from radiographic images and entered into standard formulae or into computer software programs, such as Fordisc if appropriate.

#### **6.4.3.4 Assessment of Ancestry**

Assessment of ancestry should adhere to the guidelines set forth by the OSAC Anthropology Subcommittee. In more complete remains, or those not altered by heat or trauma, estimates of ancestry may be provided.

Assessment of ancestry can be attempted on more complete crania that include the facial skeleton.

Well-accepted or validated methods for analyzing non-metric features may be used to assess ancestry.

Measurements relevant to assessing ancestry may also be taken and utilized with a computer software program such as Fordisc if deemed necessary.

#### **6.4.3.5 Estimation of Stature**

Estimation of stature should adhere to the guidelines set forth by the OSAC Anthropology Subcommittee. Stature estimates are often limited or not possible in DVI contexts, especially in cases where remains are fragmented and sex and ancestry of the individual is not known. For more complete skeletal remains, or those not altered by decomposition or heat-alteration, estimates of stature may be provided.

Measurements from long bones, including incomplete long bones, can be utilized with a computer software program such as Fordisc, although it is not recommended to completely excise long bones from soft tissue in order to obtain measurements. In some cases, osteometric measurements may be derived from digital imaging. Measurements should be adjusted to dry bone values when warranted.

#### **6.4.3.6 Features that May Facilitate Identification**

In some cases, skeletal features, such as healing or healed antemortem fractures, or rare characteristics of the bones, noted on postmortem radiographs, may be used to suggest identifications, if the proper antemortem record is available.

In those cases in which an artificial appliance or prosthetic device is associated with the human tissue specimen, identifications can sometimes be made via comparison of antemortem and

postmortem radiographs or investigation of manufacturer markings (including insignia, lot numbers, and serial numbers). The tissue can be removed or modified in order to look for manufacturer markings after the remains have been processed by the Pathology Station. The OSAC DVI Subcommittee Reconciliation document provides best practices pertaining to DVI specific identification.

### **6.5 Reconciliation**

Anthropologists provide an important role in final reconciliation of the remains, which will be addressed in more detail in the OSAC DVI Subcommittee Reconciliation best practices and guidelines document.

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## **Annex A (informative)**

### **Foundational Principles**

Disaster victim identification (DVI) refers to the component of fatality management of a mass fatality incident that involves the scientific identification of human remains.

The purpose of DVI Subcommittee is to advance the scientific basis for disaster victim identification by assembling professionals from the DVI community in a collaborative effort to exchange ideas regarding scientific analysis methods, protocols, training, and research related to DVI. The DVI Subcommittee will develop, disseminate, and advance consensus guidelines and best practices, studies, and other recommendations and/or findings for DVI, with an emphasis on quality assurance and quality control processes and methods. The DVI Subcommittee should also encourage and evaluate research and/or innovative technology related to DVI.

DVI practitioners are encouraged to develop, implement, exercise, and review their mass fatality incident response operating procedures in light of these guidelines and best practices, and to update their procedures as needed. It is anticipated that these guidelines will evolve as future technologies emerge, and will expire five years from the adoption date.

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