

International standards in cases of mass disaster victim identification (DVI)

Rüdiger Lessig · Markus Rothschild

Accepted: 30 July 2011 / Published online: 21 August 2011
© Springer Science+Business Media, LLC 2011

Introduction

Mass disasters with a large number of unknown victims are among the biggest challenges for the police and forensic disciplines. Historical events illustrate the development of different methods which can be used in such circumstances. The fire in the Ring-Theater of Vienna (Austria) in 1881 with 449 victims of which 284 were subsequently identified [1], or the fire in the Bazar de la Charité in Paris (France) with 126 victims in 1897 [2] are examples of the usefulness of identification procedures such as forensic autopsy, odontology, and finger printing. These two disasters from the nineteenth century were the beginning of modern identification processes in legal medicine [2]. In the following years several major accidents, especially after the introduction of regular civil air transportation services, demanded an effective disaster victim identification (DVI) system. Even today the identification of victims of mass disasters is still one of the most important tasks. Forensic experts are involved in different ways depending on the country of residence, and include forensic pathologists, forensic dentists, forensic anthropologists, forensic molecular biologists and other specialists. The organization

of the identification process differs from country to country, and within the countries, depending on the historical and political structures and on the kind of disaster. The success of the identification essentially relies on the organization, the experience, and the documentation of findings. The communication between countries or states can be difficult, particularly in cases where victims have different nationalities. Therefore, the solution to such problems should be a standardized process.

The recent natural disaster in Japan, triggered by a massive earth quake, also illustrates the need for standards in cases of radioactive contamination. Nobody has experiences in cases of simultaneous chemical, biological, or radioactive/nuclear (CBRNE) situations and assaults with a large number of contaminated bodies.

Standards

The events following the 2004 tsunami in South East Asia shall serve as an example for the necessity of standards in the Disaster Victim Identification process. During this mass disaster, forensic scientists and police organizations started to develop standards for the identification process based on their practical experiences. The workflow in the Thai Tsunami Victim Identification Centre (TTVIC) was the first example of a multinational body where experts from more than 30 international teams collaborated not only in the post mortem investigations, but also in all subsequent identification processes.

The documentation of the workflow, responsibilities, and other important issues influencing the decision making process have been published in the Tsunami Evaluation Report of Interpol [3]. This report highlights all positive and negative aspects influencing the efficiency of the entire

R. Lessig (✉)
Institute of Legal Medicine of the Martin-Luther-University of Halle-Wittenberg, Franzosenweg 1, 06112 Halle (Saale), Germany
e-mail: ruediger.lessig@uk-halle.de

M. Rothschild
Medical Faculty, Institute of Legal Medicine, University of Cologne, Cologne, Germany

identification process. Interpol, as the largest international police organization with 188 member countries (May 2011), is a good platform to draw appropriate conclusions from these experiences.

The Interpol Standing Committee on DVI developed guidelines for all aspects of the identification process [4]. This committee includes three working groups: forensic odontology, forensic pathology, and police working groups. These working groups have several subgroups as described in Table 1.

Following the current Interpol DVI guidelines [5, 6] the methods for the identification process are classified into two groups: primary and the secondary identification (ID) methods. Forensic odontology, fingerprints and the forensic molecular biology constitute primary ID methods. All other procedures represent secondary ID methods.

The methodological standards reported here were developed particularly over the last few years. For example

taking fingerprints, palmprints and footprints from infants is one of the standards [7].

An overview of the standards in forensic pathology, odontology and molecular biology is given in Table 2. The role of the forensic pathologist is multicentric due to the need for pathologists to participate in different parts of the identification process [8]. In addition, the DNA Commission of the International Society for Forensic Genetics (ISFG) published specific recommendations [9] for DNA laboratories that can also be used as a basis for international cooperation. Subsequently, Lee et al. [10] reported on the adoption of these recommendations in Australia and New Zealand. As shown by Lee et al. [10], there is clearly a need for certain local structures to adopt international recommendations and to be provided with a more detailed guidance to the appropriate DVI responders. This was illustrated by the mortuary operations in the aftermath of the 2009 Victorian bushfires [11]. The recently agreed upon standards of the German DVI Team for forensic molecular genetics [12, 13] are described in Table 2. These standards can be adapted to the circumstances in international cooperation after a final decision of the commission.

Table 1 Subgroups of the working groups

| Forensic pathology | Forensic odontology | Police |
|--------------------|----------------------|--|
| DNA | Dental forms | Victim recovery form |
| Anthropology | Expert qualification | Training |
| Imaging | CT-imaging | IT/large data |
| CBRN-E | CBRN-E | International DVI management exercise AM data collection Forms CBRN-E |

Conclusion for identification

The collection of ante and post mortem data can lead to a successful result only if these data have been obtained following international standards. The generally agreed upon international [5] and national [12] procedures require an expert report in one of the primary identification methods (DNA, forensic odontology, finger printing) in order to establish identity. This has to be consistent with all of the other information available.

Table 2 Overview of recommended standards

| Forensic pathology | Forensic odontology | Forensic molecular biology |
|---|--|---|
| Participation of a forensic pathologist in the recovery | Jaws will not be taken out. Only if an examination is not possible be will the lower jaw and upper jaw removed (upper jaw is left in situ). In selected cases a preparation of both jaws is possible. After the investigation a facial reconstruction is required following aesthetic aspects. | The PM samples shall be collected as described by Prinz et al. [9]. In addition to recommendation #3 the following can be used for victims with putrefaction: healthy teeth (the extraction of a tooth is permitted only after documentation in the dental chart and approval by the responsible forensic dentist) and/or fingernails [13]. |
| Full autopsy if possible | X-ray of the teeth | Ante mortem (AM) sample collection is based on recommendation #4 of Prinz et al. [9]. |
| Use of imaging techniques if necessary | Estimation of the age | AM samples of genetic relatives have to be collected in every case and sample storage shall only be carried out by trained personnel. |
| Participation in the identification process | Analysis of the used prosthetic materials in special cases for detection of the country of origin. [8] | The selection of genetic markers has to be performed by the police authority in charge after consultation with specialists (e.g. forensic geneticists). |
| Determination of the cause of death if possible and necessary | | X- and Y-chromosomal STRs, mitochondrial DNA sequence markers or SNPs can be used in addition. |
| Reconstruction of the accident using pathological findings | | |

Summary

The identification of victims in cases of mass disasters is one of the most important tasks for forensic pathologists. A number of disaster victim identification (DVI) teams in many countries have been set up over the past several years. This often follows local standards in the process which can cause problems in international cooperation; i.e. it is essential for different national teams to have international standards for a successful identification process. Many steps have been recently carried out regarding these issues. Currently, the Interpol Standing Committee on DVI is working on uniform international standards. The established national standards are reported, many of these originating from the experiences after the 2004 Tsunami.

References

- Klein A. Die Identifizierung durch die Zähne bei Brandkatastrophen. Ihre forensische Bedeutung. *Schweiz Monatsschr Zahnheilkd.* 1929;38(10):607–28.
- Amoëdo O. The role of the dentists in the identification of the victims of the catastrophe of the ‘Bazar de la Charité’, Paris, 4th May 1897. *Dent Cosmos.* 1897;39(11):905–12.
- INTERPOL Tsunami Evaluation Working Group. The DVI response to the South East Asian Tsunami between December 2004 and February 2006. 2010. www.interpol.int/Public/DisasterVictim/TsunamiEvaluation20100330.pdf.
- Interpol. 2011. www.interpol.int.
- Interpol. Disaster Victim Identification Guide. 2009. www.interpol.int/Public/DisasterVictim/guide/guide.pdf.
- Sweet D. INTERPOL DVI best-practice standards—an overview. *Forensic Sci Int.* 2010;201:18–21.
- Albrecht K, Breitmeier D, Freimuth H, Landmesser B, Lehmann P, Lessig R, Heer R, Tietze S. Leichendaktyloskopie—Informationen zur Tatortarbeit. *Bundeskriminalamt März:Informationssblatt des Bundes und der Länder;* 2007.
- Lessig R, Aspinall L, Bratzke H. Identifizierungstätigkeit bei Massenunfällen und Katastrophen—Aktuelle Standards. *Rechtsmedizin.* 2009;19:209–11.
- Prinz M, Carracedo A, Mayr WR, Morling N, Parsons TJ, Sajantila A, Scheithauer R, Schmitter H, Schneider PM. ISFG: Recommendations regarding the role of forensic genetics for disaster victim identification (DVI). *Forensic Sci Int Genet.* 2007;1:3–12.
- Lee J, Scott P, Carroll D, Eckhoff C, Harbison SA, Lentile V, Goetz R, Scheffer JW, Stringer P, Turbett G. Recommendations for DNA laboratories supporting disaster victim identification (DVI) operations—Australian and New Zealand consensus on ISFG recommendations. *Forensic Sci Int Genet.* 2008;3:54–6.
- Leditschke J, Collett S, Ellen R. Mortuary operations in the aftermath of the 2009 Victorian bushfires. *Forensic Sci Int.* 2011; 205:8–14.
- Lessig R, Aspinall L, Krumm P, Wiegand P, Hohoff C, Steinlechner M, Roewer L, Edelmann J, Bastisch I. Standards zu forensisch-molekulargenetischen Untersuchungen bei Massenunfällen und Katastrophen. *Rechtsmedizin.* 2009;19:321–4.
- Lessig R, Edelmann J, Aspinall L, Krumm P, Bastisch I, Wiegand P, Hohoff C, Steinlechner M, Roewer L. German standards for forensic molecular genetics investigations in cases of mass disaster victim identification (DVI). *Forensic Sci Int Genet.* 2011;5(3): 247–8.