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REVIEW ARTICLE

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Odontological identification of the victims of flight AI.IT 5148 air disaster Lyon-Strasbourg 20.01.1992

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Abstract The authors report on the contribution of odontological identification of the flight AI.IT 5148 air disaster victims, which occurred on 20th January 1992. The identification procedure was difficult due to large numbers of bodies and mutilations and required the involvement of multidisciplinary teams composed of odontologists, forensic pathologists, radiologists and biologists. The authors set up a simple, discriminant classification which was easy to handle by a multidisciplinary team. Four groups were defined according to the matching characteristics between ante and post mortem data. Perfect matching characteristics between ante and post mortem data were achieved in only 44 cases (Group A). Partial matching characteristics between ante and post mortem data were achieved in 12 cases (Group B). In 29 cases, the insufficiency or absence of odontological data (Group C and D) did not enable the victim to be identified. The results of the investigations showed that the dental examination alone enabled 17 victims to be identified and by including a morphological examination the figure reached 33. By the end of the investigations, 85 of the 87 victims were positively identified. Odontological identification is an essential, accurate and rapid method with allows a body to be identified from its dental characteristics. This anthropometrical method of identification is included with the descriptive and the biological methods. The authors present their experience in performing a formal identification of 44 victims in less than 15 days.

Key words Mass disaster · Victim identification · Forensic odontology · Air disaster

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Introduction

The identification of victims of an airline disaster is essential both from the humanitarian point of view and for juridical reasons. In fact in France, from the legal point of view, the issuing of a death certificate for an individual requires either identification of the body among the victims or proof that the person was on board the plane. Without this information and in the case of a missing person, a 10-year delay is required before any judgement certifying the person as missing can be made. On a humanitarian level, victim identification is important for families to be able to begin mourning.

The authors provide a report on the contribution of odontological identification of the flight AI.IT 5148 air disaster victims, which occurred on 20th January 1992. An airbus A320 from Air Inter left Lyon-Satolas airport for Strasbourg at 6.30 pm. At 7.21 pm., the radar pulse disappeared from the screen. The remains of the plane were discovered 4 hours later south of Mount Sainte-Odile, a 20-minute walk from the nearest road. Of the 90 passengers and 6 crew members, 9 survivors were found. Identification operations were rapidly carried out under the direction of the examining magistrate.

When a catastrophy takes place, identification is always difficult due to the large number of bodies and mutilations [5, 8, 9, 15, 17] and requires the involvement of multidisciplinary teams composed of odontologists, forensic pathologists, radiologists and biologists [2, 10,

15]. Odontological identification is essential as it allows a body to be identified from the dental characteristics. This anthropometrical method of identification may be included with the descriptive and the biological methods [3, 6, 7, 12, 13, 18].

The identification techniques used are comparative. They compare a dental chart made on a body to the information given by the families and in particular by family dentists. These charts were chosen by the odontologists owing to their convenience among professionals which also seemed of a higher standard than the one proposed by Interpol. Dental radiographs for identification purposes were also used.

Material and methods

The accident scene was preserved in order to allow a detailed map to be drawn and photographs to be taken. This is essential for legal and administrative investigations. The location of the bodies, personal belongings and fragments of the aircraft were carefully noted. Along with this "in situ" record, a form requesting information about the victims was sent to each family. A clothing description, dental and anatomical details known by the family were to be recorded on the form. Also requested were the addresses and telephone numbers of the victims' doctors and dentists.

Each body or part of the body was then stripped in the presence of the investigators and an external examination was carried out for anatomical characteristics. Fingerprints were taken. Subsequently, a systematic forensic autopsy was carried out beginning with a dental examination by the odontologists.

Two teams of 2 odontologists each were put in charge of collecting ante-mortem odontological data (usually on yellow ante-mortem charts in France, Fig. 1), and of drawing up dental charts of the bodies. Ante-mortem information was to be presented in a way compatible with the post-mortem classification. Teeth numbering, even X-ray photographs, can vary from one practitioner to another and from one country to another. All the information given by the family doctor is essential: treatment records, X-ray photographs, retro-alveolars, orthopantomograms, castings, prostheses records, photographs.

The collection of post-mortem information (pink post-mortem charts in France, Fig. 1) was carried out by 2 odontologists per autopsy table, who worked in cooperation with forensic pathologists. The different examination techniques consisted either of the simple inspection of the oral cavity or the resection and removal of the upper and lower jawbones. A simple inspection was often difficult and inaccurate because of the state of the bodies and rigor mortis. Thus, the second technique was favoured. This consisted of a bilateral temporo-mandibular dislocation after a muscle and ligament dissection at the mandible or distal sectioning with the jawbone of the wisdom teeth and a Lefort I type ostectomy at the jawbone. The second stage was to proceed with an extemporaneous odontogram chart on the pink files, at the same time trying to damage the soft facial tissues as little as possible. Given the high number of major skull and face fractures noted, jawbones were often

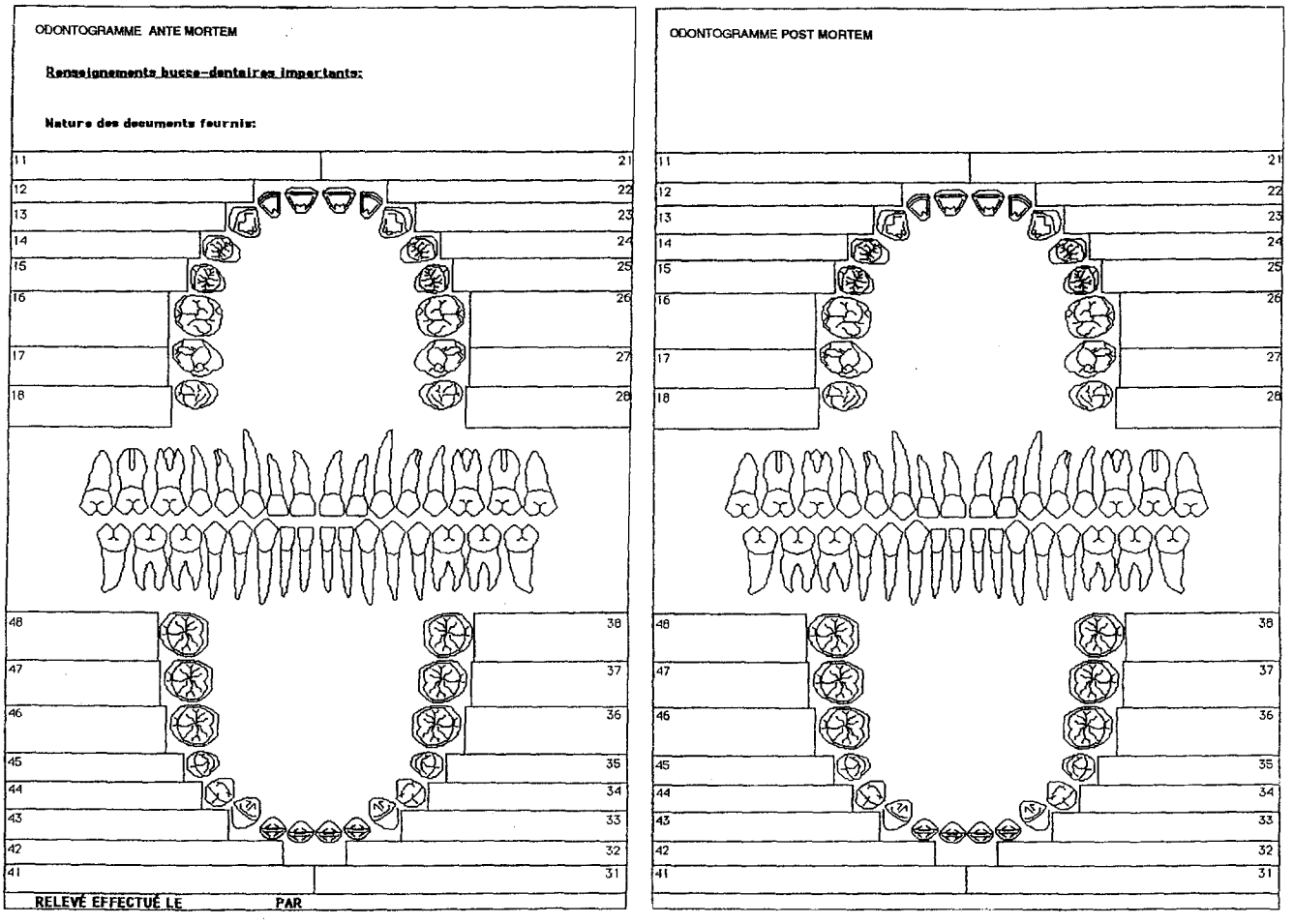

Fig. 1 Ante- and post-mortem odontograms used for the dental ID

broken, scattered or incomplete and sometimes charred, which made identification work more difficult. The jawbones or the jawbone fragments were removed, cleaned, their characteristics recorded, photographs and X-ray photographs taken. The jawbones were then tagged and kept in cold storage. The method, complemented by macro-photographs and X-ray photographs is quick, effective and accurate. The number of concordant points necessary for the establishment of a positive identity is not fixed and can vary between countries (12 concordant characteristics in Sweden and Switzerland, 17 in France) and depends on the type of dental characteristics found on the victim. If an unusual feature is found, this element may be sufficient [4].

It is also necessary to look for dislocated teeth on the ground, in the throat and soft tissues as well as for lost or swallowed prostheses.

The comparative identification criteria used are: the number and position of the teeth which is the most common proof and takes into account fractures and the post-mortem dental dislocations, teeth extracted or treated between the last treatment and the accident, or even the teeth incorrectly noted, restorations (treatment and prostheses), although such treatment might have been carried out by another dental surgeon or stomatologist between the time when the odontological recording was made and the death of the patient.

At present, it is preferable to examine each restoration individually. An ante- and post-mortem correlation is made by comparing the yellow and pink files. The comparison must be made by the odontology team. When ante- and post-mortem data and the data recorded by the other members of the forensic team concurred, the identification was announced by the team coordinator, in this case the Director of the Forensic Medicine Institute.

We set up the following classification which seems simple, discriminant and in line with the work and comprehension of a multidisciplinary team:

Group A:

Perfect matching characteristics between ante- and post-mortem data allowing for the identification of the person concerned.

With a slight difference:

Aa: perfect matching characteristics of sufficient ante- and post-mortem data allowing for the identification of the person concerned.

Ab: perfect matching characteristics of incomplete ante- and post-mortem data, but enough to allow for the identification of the person concerned.

Group B:

Partial matching characteristics of ante- and post-mortem data enabling the identification of the person concerned, providing that other non-odontological elements are present.

From this stage onward, we took into account the lack of ante- and (or) post-mortem information, and subdivided this group into 2 subgroups:

B1: partial matching characteristics, despite the relative lack of sufficient ante-mortem data, enabling the identification of the person concerned, providing that other non-odontological elements are present;

B2: partial matching characteristics, despite the relative lack of sufficient post-mortem data, enabling the identification of the person concerned, providing that other non-odontological elements are present.

Group C:

Possible matching characteristics of ante- and post-mortem odontological data, although not enabling the odontological identification of the person concerned given the number of possible points of comparison:

C1: lack of ante-mortem information;

C2: lack of post-mortem information;

C3: lack of ante- and post-mortem information.

Group D:

Impossible odontological identification on account of the absence of elements of comparison.

D1: absence or serious lack of ante-mortem information;

D2: absence or serious lack of post-mortem information;

D3: absence or serious lack of ante- and post-mortem information or correlating elements.

Results

1. Collection of ante-mortem information

The dental surgeon in charge of the investigation often has to deal with incomplete ante-mortem dental charts, errors on the position and numbering of teeth.

No ante-mortem odontological information was found for only one of the victims.

2. Collection of post-mortem information

The victims were from a high socio-cultural background, so treatment was regular, quite numerous and often discriminant. However, a great number of victims had serious face and skull damage with fragmentation of jaw and dental structures. It was also necessary to search far from the accident scene and in the tissues of the body for fragments of teeth, jawbones or prostheses. The dental examination proved conclusive for the identification of the 6 badly burnt victims following a localized fire which broke out after the crash.

Of the victims 19 could not be identified because of the serious lack or absence of odontological fragments. The genetic analyses allowed for the identification of 17 victims out of the 19 bodies.

No biological evidence was found for 2 victims who could not be identified.

3. The role of X-ray documents

The contribution of ante-mortem retro-alveolar or panoramic X-ray photographs to comparative identification procedures is essential. The photographs are useful to observe bone structure, sinus shape, impacted teeth, root canal obturations, centers of infection, recent traces of avulsion, the degree of alveolar bone loss and to estimate the age of the victims.

Post-mortem X-ray photographs, in particular shots of jawbone occlusion after removal, were systematically taken at the Forensic Medicine Institute and enabled a comparison to be carried out with the ante-mortem data by visual examination.

The X-ray examination was effective for the study of the burnt jawbones and jawbone fragments. Some X-ray photographs of jawbone fragments with teeth provided important evidence for positive or negative identification through a comparison with the ante-mortem shots.

In one particular case, a characteristic over-extended filling of paste with granuloma at the apex level and an incomplete obturation at the other root level allowed the identification by matching of the ante- and post-mortem X-ray photographs on a jawbone fragment.

4. The prostheses

Removable prostheses, which had sometimes fallen out during the accident, were found several days, or even months later. These often confirmed identification as a result of the ante-mortem information and by reinserting them in the removed jawbones.

The identification of a completely toothless person was carried out by exclusion. Another person was identified through a recent partial stellite prosthesis by means of the casting which had been kept by the family doctor.

The results of the investigation showed that the dental examinations alone enabled 17 victims to be identified and by including a morphological examination the figure reached 33.

With regard to dental identification, perfect matching characteristics between ante- and post-mortem data were achieved only in 44 cases allowing for the identification of the person concerned (Group A). In 12 cases, partial matching characteristics between ante- and post-mortem data were achieved, but nevertheless it allowed for the identification of the person concerned, providing that other non-odontological identification elements were present (Group B). In 29 cases, the insufficient or absent odontological data (Groups C and D) did not enable the victim to be identified (Figs. 2 and 3).

By the end of the identification operations, 85 of the 87 victims were positively identified.

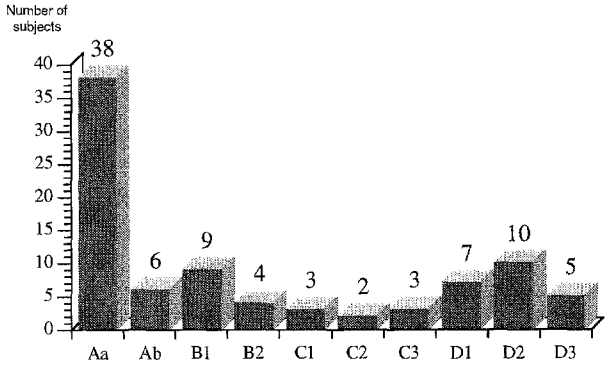

Fig. 2 The figure shows the number of individuals in each odontological identification class

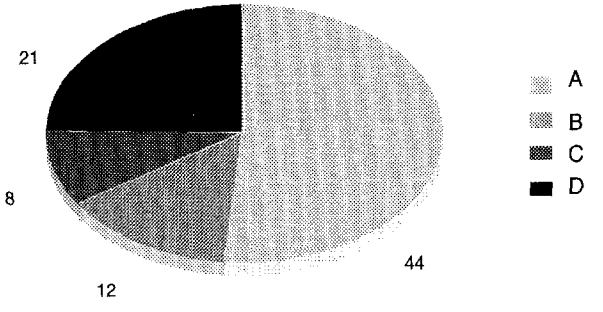

Fig. 3 Importance of the main dental identification classes: A, B, C and D

Discussion

Odontological identification, which is apparently simple, can prove extremely difficult in certain circumstances such as mass disasters. The risk of error (and therefore identification or non-identification) is always possible with the human, scientific and deontological consequences that it entails. It is important that the operation be organized, systematic and well thought out, since odontological identification alone can bring the proof sought after. Even today, it is clearly one of the commonest, quickest and among the cheapest identification methods.

The success in odontological identification is consistent with the findings in other mass disasters [1, 5, 11, 16, 17].

1. The importance of data collection

To carry out a quick and reliable odontological identification, it would be desirable that information be better distributed at the level of the family doctors. It is vitally important that family doctors systematically establish a complete and up-to-date chart of the treatment given to their patients and file all the X-ray photographs as well as all the documents concerning the work. The comparison of ante-mortem and post-mortem radiographs is accepted as a method in forensic dental identification. The bitewing radiograph used to detect interproximal dental caries is the most commonly taken radiograph and is able to record fine details of anatomy, disease and dental treatment [14]. The location, shape and unique characteristics of each restoration can be compared with great accuracy but Borrman and Gröndhal [4] reported that in some cases positive identifications were unable to be made with this kind of radiography without dental restorations. Furthermore, this would help them in daily management and drafting the various administrative documents. This is the case for paper files and even more so for the computerized files whose future clearly lays in magnetic cards which record the medical and dental history of each patient. With regard to ante-mortem data research, it would be advisable to make note of as much odontological information as possible and in the most efficient way during pre-employment medical examinations, routine examinations or occupational medicine examinations.

In some cases, it is useful to know the name of the dental surgeons who treated the missing person (in general through the family), a change of practitioner as a result of moving or other reasons, specialists.

2. The role of odontologists within the forensic team

a) At the scene of the disaster:

It is essential that an odontologist should be present at the scene of the disaster as soon as possible. Although all forensic odontologists and the higher authorities in the profession believe it essential, an effective stand-by odontological emergency team is already operational.

Such a structure should be extended to cover the entire French territory, or even internationally.

b) Like other practitioners, odontologists should be able to join any Forensic Medicine Institute.

This trained specialist who can be called up quickly should, if necessary, be able to set up an effective forensic odontological team as quickly as possible and in conjunction with the director of the Forensic Medicine Institute, and be able to coordinate it. This team should be able to prove its real efficiency in a pluridisciplinary framework by working in perfect symbiosis with all the members of the forensic team and the legal authorities.

Conclusions

In the flight AI.IT 5148 air disaster we performed a formal odontological identification in more than 50% of the cases. In 12 cases, identification was achieved through odontological data and other non-odontological elements. In 29 cases, odontological data proved insufficient. Identification through bucco-dental data appears in theory, relatively simple and should be part of the work of all odontologists.

This study points out, once more, the importance of having trained forensic odontologists involved in the team working in mass disaster situations.

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