

Suicidal Terrorist Bombings in Israel—Identification of Human Remains

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ABSTRACT: Positive identification of human remains is one of the most important tasks in mass disaster investigations. Religious and jurisdictional demands in Israel, require the identification process to be completed in the shortest possible time. In the 18 suicidal terrorist bombings that took place in Israel between the years 1993–1996, 127 victims and 19 perpetrators were killed, and their severely fragmented bodies were identified within 24 h. The efficient completion of the identification endeavor was enabled by the implementation of a variety of techniques and the close collaboration in the investigation between the different emergency and forensic agencies. This paper presents the mass disaster identification policy and techniques currently used in Israel. The importance of an interdisciplinary approach for the identification of extremely fragmented human remains from mass disasters and the creation of a central data bank of fingerprints and genetic markers is emphasized.

KEYWORDS: forensic science, identification of human remains, suicidal bombing, mass disaster management policy

The identification of human remains is one of the most essential aspects of forensic medicine. Beyond the humanitarian considerations of such a task, identification is essential for the completion and certification of official documents such as death certificates, wills, and disbursement of benefits and insurance (1,2). In mass disasters, the positive and swift identification of the victims is of cardinal importance. This endeavor is rendered more arduous when the victims have been disfigured or fragmented, as in the case in bombings (3).

Radical Muslim militants opposing the peace treaties between the State of Israel and the Palestinian People (4) have committed 18 suicidal bombings in Israel over the last three years. The perpetrators carried explosive devices containing various metallic objects either strapped to their bodies or in a vehicle. The bombs were detonated by the perpetrators in crowded public places such as buses (Fig. 1) causing severe fragmentation of the bodies (Fig. 2) due to the close proximity of the victims to the epicenter of the explosion (5).

These incidents took the lives of 127 victims and 19 terrorists (Table 1). The injuries of the victims varied between total disruption of the body (17.4%), explosive injuries (69.7%), injuries produced

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FIG. 1—Scene of a suicidal bombing inside a crowded bus.



FIG. 2—Severe fragmentation of a suicidal bomber. Body parts are re-associated by means of genetic markers.

by flying debris (10.4%) and blast injuries (2.3%) (3). The standard operating procedure involved in the identification of victims of suicidal bombings and the main caveats encountered during the investigation are discussed below.

TABLE 1—Distribution of age, sex, and identification methods.

Incident No.	Victims		Identification Method				
	Males	Females	Visual	Finger Prints	Dental	Medical	DNA
1	2 (30-48)	7 (13-55)	7	1	1	—	—
2	5 (20-49)	1 (49)	6	—	—	—	—
3*	2 (26-27)	—	1	—	—	—	—
4	8 (25-83)	14 (20-74)	11	4	3	2	2
5*	4 (21-36)	—	3	—	—	—	—
6	1 (21)	—	1	—	—	—	—
7	19 (19-35)	2 (19-20)	1	15	3	—	2
8	2 (21-80)	4 (60-64)	—	—	—	5	1
9*	1 (22)	—	—	—	—	—	—
10*	1 (24)	—	—	—	—	—	—
11	4 (19-21)	2 (19-21)	—	5	—	1	—
12	2 (23-35)	3 (23-51)	1	2	1	—	1
13*	1 (21)	—	—	—	—	—	—
14	1 (22)	—	—	1	—	—	—
15	1 (20)	1 (25)	1	—	—	—	1
16	18 (16-61)	7 (19-59)	8	11	5	—	1
17	14 (16-63)	6 (27-66)	13	2	4	—	1
18	4 (13-56)	9 (15-76)	7	—	2	2	2
Total	90	56	60	41	19	10	11

NOTE—Figures in parentheses indicate age range of victims.

*Indicates perpetrator's method of identification is classified.

Materials and Methods

The experience accumulated during the last three years by all the agencies involved in recovery, treatment, and identification of victims from terrorist bombings, has generated the following mass disaster management policy currently in effect in Israel, which the following comprises five main sequential steps.

Summons—Immediately upon receiving a report of a terrorist bombing, a multi-agency disaster plan is put into action. The relevant personnel of the national disaster management team are summoned through a statewide paging system. These include medical and paramedical, police, military, forensic and religious agencies: a. Medical and paramedical: Local Magen David Adom (equivalent to the Red Cross), and staffs of the local hospitals and Israel Defense Forces (IDF), b. police: regional's police units and military police, c. Forensic: Staff of the Ministry of Health L. Greenberg Institute of Forensic Medicine (the Institute) and the National Police Division of Identification and Forensic Science (DIFS), d. mental health: Teams of psychologists and social workers affiliated to the local municipality, and e. religious: National and local Jewish Orthodox voluntary organizations.

Scene Investigation—The local and/or military police forces are responsible for securing the bombed area to prevent access of unauthorized civilians and press, and preserve the evidence. Police Bomb Squad Units sweep the area for possible undetonated explosive devices, and collect all relevant data on the exploded bomb before any other technical personnel are authorized into the area (6).

As soon as the area has been cleared, the medical teams take over and direct the wounded to the preselected local trauma centers. The procedures of the various medical and paramedical units in major disasters will not be discussed here because it is beyond of the scope of this paper.

The main task of the regional Police Mobil Criminal Laboratories Units is to prepare video and photo-documentation of the

exact position of all bodies and body parts and their spatial relation to personal effects scattered at the scene. The remains are sequentially numbered and collected into plastic body bags (7). Bodies and body parts are gathered and transported to a nearby medical center or funeral facility and from there to the Institute, which is located in Tel Aviv (the most central city in the country). Personal effects recovered at the scene are transferred directly to the Institute.

Orthodox Jewish volunteers are in charge of collecting all body fragments and blood soaked objects and delivering them to the Institute. This activity is considered by Jewish tradition a sacred duty, because according to religious law, all tissue and blood should be buried (8).

Forensic pathologists and anthropologists are not involved in the crime scene investigation; their activity is confined to the Institute premises. While the bodies are being documented and recovered at the scene, the pathology-biology forensic teams prepare the facilities for the incoming victims.

Activation of an Information Center—The Information Center (IC) is set up in a working area adjacent to the Institute in order to facilitate the concentration and flow of information as well as to prevent overcrowding at the Institute by next of kin and the press.

The IC is activated by a special unit of the DIFS and is manned by local police investigators, social workers, and psychologists. The main task of the IC is to obtain and catalogue antemortem data from individuals searching for missing persons and to exchange information with the forensic teams (9). The phone number of the IC is broadcasted nationwide, encouraging people searching for missing relatives to contact the authorities.

Antemortem data were once collected using Interpol Missing Persons Forms which were translated to Hebrew. Because these questionnaires are extremely cumbersome and include irrelevant questions, a shorter version devised by the DIFS has been implemented for the last incidents. During data processing, the bereaved are provided with psychological assistance by municipality health services.

Postmortem Data Collection—As the human remains are brought to the Institute, they are numbered and impermeable identification tags affixed on them. A member of the forensic team "The Tracker" (10) is in charge of recording incoming bodies, matching the numbers given at the scene with those of the Institute, ascertaining the location of the body at all stages of the procedure, completing postmortem records and maintaining the traffic of information between the IC and the Institute.

Each body is transported on a gurney from station to station, as follows: a. forensic external examination station: Here, the body is photographed by the Institute photographer. Clothing and personal belongings are then removed by technicians after proper documentation and transferred to the IC. Body fluids and tissue are sampled, labeled, and delivered to the forensic biology laboratory, following the pathologist's and anthropologist's external examination of the remains, which includes description of injuries sustained and individual characteristics (Fig. 3). b. forensic odontology station: Here, a team of odontologists either from the Police Volunteer Unit, or the IDF, or a forensic anthropologist prepares a dental chart and takes Polaroid photographs of the dentition (11). c. fingerprints station: Here identification technicians from the Mobile Laboratories of the Police roll fingerprints (12). d. Radiography station: Here, dental and whole body X-rays are taken by



FIG. 3—Individualizing characteristics such as partial syndactilia of a burnt hand used for positive identification.

forensic anthropologists and IDF technicians (13). Recently a fluoroscopic screening of the bodies has been introduced in order to expedite the location and retrieval of foreign bodies. e. forensic internal examination station: Documentation of internal injuries is carried out in this station. Furthermore, based on the radiographic information gathered at the previous station, a forensic pathologist extracts all foreign bodies which are later used by the Police Bomb Squad experts in the identification of the explosive device (14). All signs of previous surgery and any other acquired or congenital pathology especially relevant to identification such as gallstones or malformed kidneys, are recorded. When possible, the facial tissue is cleaned and restored in order to spare the families' feelings when viewing the remains. Once the postmortem file is completed, the Tracker directs the body to the storage area. The collected information is then relayed to the IC in order to make comparisons for possible identification. f. Reassociation of body fragments: After all complete and partially complete bodies have been processed, the forensic teams address the body parts. The forensic pathologists and anthropologists classify, describe, and photograph all the parts and take tissue samples for biological matching. Anatomical reconstruction of the fragmented bodies is accomplished through physical matching of the torn parts. Those segments that can not be approximated by gross anatomical morphology are analyzed at the tissue level and matched by Phosphoglucumutase-1 (PGM) and DNA typing (15).

Communication with the various trauma centers treating the wounded is of paramount importance. All admitted amputees have to be reported to the IC in order to avoid overestimation of fatalities based on body fragments at the Institute.

Identification—The comparison of antemortem and postmortem data for positive identification is performed by the relevant experts and ratified by a senior forensic pathologist, following rabbinical assent when applicable. Positive identification is established through at least one of the commonly recognized techniques, i.e., fingerprints, dental, radiographic, medical or biological methods, or by visual recognition of relatively well preserved facial morphology.

Results

Visual Recognition

In the forensic sciences, recognition of the deceased by family members or friends falls within the realm of presumptive identification (7). Under Jewish Law (the Halacha), visual identification in itself is acceptable provided that the face or a unique external body feature is completely or partially preserved in such a way as to comply with Halachic laws (16).

In multi-victim situations, such as those discussed here, visual recognition plays an important role in the resolution of the identification process (7). After the probable identity of the victim has been established, based on data collected at the scene and from the cadaver, such as documents and personal effects, which is then compared to antemortem records, confirmation of identity is often obtained by the visual recognition by the next of kin.

The body is viewed by the family in the reception room through a closed circuit video camera, or if requested, through a viewing window that opens into the storage area of the Institute. Viewing of the body is done in the presence of a Rabbi, who ensures that the process of visual identification complies with Jewish religious requirements, when applicable. The bereaved are permitted to view the victim for as long as they wish and as many times as they request. The family is accompanied at this time by a representative of the forensic team and a police officer or a mental health official (psychologist or social worker).

Out of a total of 146 cadavers, 60 were identified by visual recognition (Table 1). In 62% of these cases, the identification was later confirmed by scientific methods prior to releasing the body for burial (Fig. 4), although in 23 of the cases, visual identification was the only means available to the forensic team.

Scientific Methods of Identification

Fingerprints: In the State of Israel, all citizens who serve in the IDF have a ten finger dactilar record in their military dossiers, which are taken on enrollment. This procedure was first implemented for male personnel in 1973 following the Yom Kippur War and in 1985 for female personnel. Thus, citizens who have not served in the IDF, or who served prior to this date, have no military dactilar records (17).

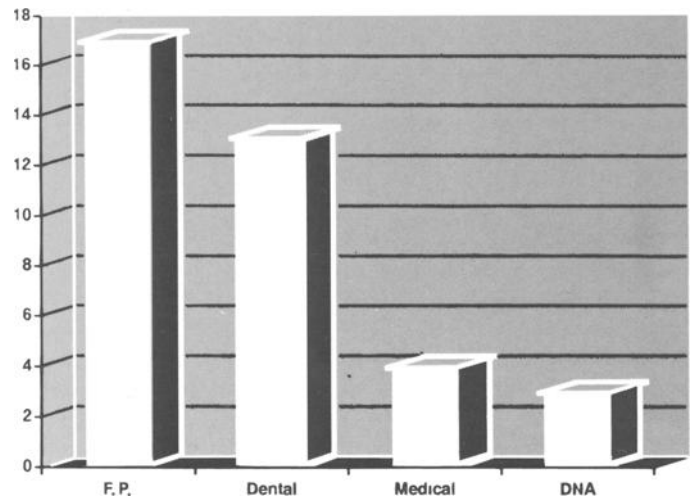


FIG. 4—Corroboration of visual identification by scientific techniques. (F.P. = Fingerprint comparison).

The IDF fingerprint data bank is available for identification of enlisted personnel or those on reserve at the time of the incident. Stored fingerprints of individuals not on active duty at the time, can also be produced on request for positive identification.

The Israel National Police also has an extensive collection of fingerprints in its computerized data bank (Automatic Fingerprint Identification System), of individuals that have been suspected of committing a crime. These are also made available for postmortem identification.

Finally, police crime scene investigators have gathered fingerprint impressions from the residences, cars, and personal effects of individuals whose identity they have wished to corroborate (18).

The dactyloscopic comparison is performed by experts from the Police Fingerprint Laboratory. From a total of 146 victims, 28% were identified by fingerprints and 17 out of the 60 visual identifications (Table 1) were confirmed by fingerprints (Fig. 4).

Dental: Antemortem dental data is obtained from two main sources: a. The IDF records of all enlisted and reserve personnel since 1973, which include a panorex radiograph, dental chart, and in some instances, Polaroid photographs of occlusal and buccal aspects of the dentition (17), and b. Dental records from hospitals and clinics.

The comparison of antemortem and postmortem records is performed by dentists and forensic anthropologists. A total of 19 cadavers were positively identified by dental comparisons (Table 1) and 21% of the visual identifications were substantiated by dental information (Fig. 4).

Distinctive characteristics and medical evidence: Information on medical conditions such as moles, cutaneous, and subcutaneous growths, foci of hyper hirsutism or depigmented areas is related by next of kin and recorded by the IC staff. Similarly, the results of surgical scars or the presence of unusual tattoos as well as physical oddities such as syndactylia (Fig. 3), or malformed external ears, are referred by the Tracker to the IC for identification.

Out of the 146 bodies, 6.8% were identified by distinctive medical characteristics or anatomical variations (Table 1), and 11.6% of the visual recognitions were substantiated by these markers (Fig. 4).

Biological: Swift typing and comparison of PGM phenotypes (19) and DNA profiles from cadaveric blood and tissue enabled reassociation of body fragments. Comparison of genetic markers to blood samples obtained from first degree relatives of the missing persons also permits positive identification.

New protocols have been implemented by the Biology Laboratory of the Institute to shorten the DNA typing procedure. The extraction of DNA from cadaveric fragments is now accomplished in approximately 1 h (20), even from tissue samples that have been subjected to very high temperatures to the point of calcination. DNA from blood samples of relatives of the missing persons is extracted using the Promega Wizard™ genomic DNA purification kit. The entire procedure is completed in less than 3 h.

After the amplification process, which is usually accomplished within 2 h, the PCR products are typed by Amplitype® HLA-DQA1, Polymarker Kits and Gene Print™ STR System (THO1;TPOX; CSF). The results are obtained in approximately 2 to 3 h.

Genetic markers were used for positive identification in 11 instances, 9 out of the 19 perpetrators, and 2 victims (Table 1). Furthermore, these markers were extremely useful in matching innumerable torn body fragments.

Discussion

The escalation of suicidal terrorism in the Middle East and other areas of the world (Pakistan, November 1995) merits careful consideration by local security forces, and medical and forensic services. The re-emergence of religious fanaticism has created an unpredictable type of urban terrorism; the common conception that perpetrators wish to inflict massive fatalities while escaping unharmed has been proved misguided. Existing security measures are thus inadequate in preventing them from attaining their goal.

The mass disaster management policy in Israel is the result of the experience acquired by the various agencies involved in the investigations of suicidal bombings over the last three years (21). The present study shows that investigation of a terrorist bombing requires very close cooperation between forensic specialists and security forces. Information obtained at the scene, such as the precise location of victims, documents dispersed by the blast or prosthetic devices like dentures, can be of invaluable assistance to the forensic teams in establishing correct identification. At the same time, trace evidence collected during autopsy is of paramount importance in the criminal investigation (14). Moreover, secret service information has been crucial in the identification of some of the perpetrators not reported as missing by their relatives for fear of retaliation from the authorities (Table 1).

Identification of the cadavers was accomplished within 24 h of the incident in 85.6% of the cases using standard identification procedures, expedited by the implementation of fast PGM and DNA typing (15) and the collection and processing of antemortem data through the Information Center. The delay in the identification of the remaining 14.4% cases was due to the lack of available antemortem data. The sequential postmortem examination procedures being carried out in the various stations greatly accelerates the compilation of the identification file and avoids "crowds" of experts around each body.

Visual recognition is considered the least desirable method of identification in the forensic sciences, especially following a terrorist attack which exacerbates the already inflamed emotions of the bereaved, causing possible errors in the identification. In Israel, because of religious constraints, the investigating team has relayed on this type of identification for 41% of the victims. Nevertheless, in 62% of the cases (37 out of 60 cases), this method was substantiated by scientific identification methods prior to the release of the human remains for burial.

Reconstruction of cadavers from body parts is of paramount importance in establishing the number of victims and by default in isolating the probable perpetrator, whose body is usually totally disrupted due to his close proximity to the epicenter of the explosion (22). On the other hand, reconstruction serves humanitarian and religious considerations (8).

From the analysis of the 18 terrorist bombing investigations carried out in Israel in the last three years, it transpires that a centralized data bank of fingerprints, dental records, and genetic markers, would greatly facilitate and expedite the identification of very fragmented human remains. Therefore, it would be desirable to store the fingerprints and dry blood stains of the entire Israeli population (9). Recently, the IDF began a DNA repository of enlisted personnel which has been instrumental in the identification of the crew of fighter aircraft accidents.

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