

# Mass Medical Repatriation of Injured Civilians after Terrorist Attack in Mombassa, Kenya: Medical Needs, Resources Used, and Lessons Learned

Maj. Meir Marmor MD; Col. Liav Goldstein, MD, MHA; Brig. Gen. Yeheskel Levi, MD; Col. Erez Onn, MD; LtC. Amir Blumenfeld, MD; Maj. Yona Kosashvili, MD; Maj. Gad Levy, MD; LtC. Gil Hirschorn, MD; Maj. Eitan Heldenberg, MD; Maj. Jacob Or, MD; Maj. Eric Setton, MD; Col. (res) Avishay Goldberg, PhD; Col. Yaron Bar-Dayana, MD, MHA

Chief Medical Director, IDF Home Front Command and the Department of Medicine E Meir Hospital and the Department of Disaster and Emergency Medicine, and the Department of Healthcare Systems Management, the Faculty of Health Sciences, Ben Gurion University, Beer-Sheva, Israel

#### Correspondence:

Col. Dr. Y. Bar-Dayana, MD, MHA  
16 Dolev st. Neve Savion, Or-Yehuda,  
Israel  
E-mail: bardayan@netvision.net.il

**Keywords:** civilians; earthquake; medical mission; needs; repatriation; resources; teams

#### Abbreviations:

IDF = Israeli Defense Forces

Received: 06 October 2004

Accepted: 30 October 2004

Revised: 03 December 2004

Web publication: 10 March 2005

#### Abstract

**Introduction:** On 28 November 2002, three suicide bombers crashed their car into a hotel in Mombassa, Kenya; 12 people were killed, including three Israelis, and 80 were wounded (22 of whom were Israeli). The Israeli Defense Force Airborne Medical Evacuation Flight Teams participated in a repatriation mission to bring the wounded home.

**Objectives:** The objectives of this study are to outline the distinctive aspects of this mission, as well as to share the experiences and lessons learned.

**Methods:** Israeli Army debriefing reports were used to study the composition of the crew, medical equipment taken, injury distribution, mode of operation, and mission schedule.

**Results:** A total of six fixed-wing aircraft were used—two Boeing 707s and four Hercules C-130s—with a total of 54 medical team members on board. A total of 260 Israelis were repatriated, 22 of whom were wounded, and three were dead. Of the casualties, 14 were conveyed sitting, and eight supine. The time from the first landing in Kenya to the evacuation of the last supine patient was 5.5 hours. Nurses, as well as social workers, played a central role in the mission. A forward team, including five doctors, was used for the initial organization and for gathering information on the medical status of the casualties.

**Conclusions:** There was redundancy in the medical crew and medical equipment sent. The need for improved infrastructure on the medical aircraft was stressed. Based on this experience, a new mode for operation for similar missions in the future was formulated.

Marmor M, Goldstein L, Levi Y, Onn E, Blumenfeld A, Kosashvili Y, Levy G, Hirschorn G, Heldenberg E, Or J, Setton E, Goldberg A, Bar-Dayana Y: Mass medical repatriation of injured civilians after terrorist attack in Mombassa, Kenya: Medical needs, resources utilized, and lessons learned. *Prehosp Disast Med* 2005;20(2):98–102.

#### Introduction

Large-scale, international, terrorist attacks recently have become common, with the 11 September attack on the twin towers in New York, the Bali nightclub attack on 12 October 2002, and the bomb explosion at the Manila airport on 04 March 2003 as examples. A need for medical repatriation of all or some of the wounded civilians could arise in such instances. Medical repatriation usually employs fixed-wing aircraft for medical escort of one or a limited number of patients.<sup>1-2</sup> The need for mass medical repatriation has

n	Age	Injury severity	Injury type	Medical treatment by mission crew
1	40	Severe	Mechanically ventilated – s/p laparotomy, Abdominal injury, fracture of left tibia, burns in lower limbs	IV fluids and supervision*, Mechanical ventilation
2	30	Moderate	Mandibular fracture	IV fluids and supervision
3	48	Moderate	Lower limb burns	IV fluids and supervision
4	9	Moderate	Foreign bodies in limbs and left shoulder	IV fluids, IV penicillin and supervision
5	35	Moderate	Face and upper limb burns	IV fluids and supervision, Urinary catheter insertion
6	50	Moderate	Head injury, left forearm comminuted fracture	IV fluids and supervision
7	45	Moderate	Foreign bodies in all limbs	IV fluids and supervision
8	18	Moderate	Right leg fracture and foreign bodies	IV fluids and supervision
9	U	Mild	Limb and face foreign bodies	Supervision
10	U	Mild	Mandibular foreign body	Supervision
11	U	Mild	Foreign bodies	Supervision
12	U	Mild	Foreign bodies	Supervision
13	U	Mild	Foreign bodies	Supervision

Marmor © 2005 Prehospital and Disaster Medicine

**Table 1**—Injury distribution in the C-130 plane: 13 patients, 7:55h flight time (n = number; IV = intravenous; \*supervision by a physician; U = unknown)

been a relatively rare event. Therefore, it is not surprising that there is very little published data on this subject. On 28 November 2002, three suicide bombers crashed their car into a hotel in Mombassa, Kenya, killing 12 people, including three Israelis, and wounding 80 (22 of whom were Israeli). Medical repatriations were performed for the purpose of continuing the treatment of these 22 persons in Israeli facilities.

### Materials and Methods

A retrospective study of three written Israeli Army debriefing reports was performed. These reports originated from the Israeli Air Force, the Army Trauma Branch, and the Army Surgeon General. The authors participated in the original debriefings. Four areas were analyzed, including: (1) medical needs (total number of injured, types of injuries, evacuation by stretcher/sitting); (2) resources used (numbers and types of aircraft, numbers and types of personnel participating, equipment used/missing); (3) time course of repatriation (mission schedule); and (4) operational strategy. Injury information was gathered only from the debriefing reports and not from individual medical records. Severity of injuries was graded as follows: (1) severe = life threatening; (2) moderate = limb/organ threatening; or (3) mild = neither life nor organ threatening. The study was performed at an Israeli Air Force facility during 2004. The authors of this study were asked to review and comment on the debriefing reports. Most of them also participated in the mission.

### Results

**Medical needs**—A total of 260 Israelis were repatriated. Twenty-two of them were wounded, and three were dead.

Type of aircraft	Flight time	Severity of Injury			Total
		Severe	Moderate	Mild	
Boeing 707	5:35h	0	0	9	9
C-130	7:55h	1	7	5	13
<b>Total</b>	<b>10:15h*</b>	<b>1</b>	<b>7</b>	<b>14</b>	<b>22</b>

Marmor © 2005 Prehospital and Disaster Medicine

**Table 2**—Mission medical aircrafts (\*from the first repatriation aircraft to take off to the last aircraft to land in Israel)

The casualties were treated initially in local facilities. All casualties needing medical supervision were flown in the C-130 aircraft (Table 1). The severely injured patient and the seven moderately injured patients were transported on stretchers, while all the mildly injured patients were seated with the uninjured civilians. The severely ill patient required mechanical ventilation. All of the moderately ill patients were receiving intravenous fluids, one required antibiotic administration, and one had an indwelling urinary catheter. The remaining patients only required supervision.

**Resources used**—A total of six fixed-wing aircraft were used in the repatriation mission. However, medical repatriation used only two aircraft (Table 2). The eight severely and moderately injured patients and five patients with mild injuries were transported in a C-130 aircraft, and the remaining patients were transported in a Boeing 707 (Table 2). Medical care was provided by 54 trained personnel: five members of the Forward Medical Team; 14 by the Israeli Air Force Rescue and Airborne Medical Evacuation

Team	Position	Number of crew members	
Forward Medical Team	Medical specialists: Medical officer General surgeon Plastic surgeon Anesthesiologist Hematologist	5	
	Team leaders (trauma surgeons)	2	
	Medical specialists: Intensive care Pediatric intensive care Emergency medicine general surgeons	4	
	ALS caregivers	7	
	BLS caregivers	2	
IAF Rescue and Airborne Medical Evacuation Unit	Medical organization officers*	1	
	Command team of senior medical officers	5	
	Surgeons and anesthesiologists	10	
	ALS	3	
	Nurses	2	
IDF Medical Corps	Medical organization officers	2	
	BLS	1	
	Social workers	2	
	Healthcare officers**	4	
	Israeli National Rescue Team	Physician and BLS	4
	<b>Total</b>		<b>54</b>

Marmor © 2005 Prehospital and Disaster Medicine

**Table 3**—Medical crew distribution (ALS = advanced life support; BLS = basic life support; IAF = Israeli Air Force; IDF = Israeli Defense Forces; \*medical organization officer is an officer with BLS training in charge of medical organization in the aircraft; \*\*healthcare officers are officers belonging to the medical crew, not connected directly to the administration of medical care)

Unit; 33 were members of the IDF Medical Corps, and four were members of the Israeli National Rescue Team. The professional composition of each of these teams is detailed in Table 3.

A list of the equipment and supplies available to the teams is in Table 4. Oxygen, non-invasive blood pressure monitoring, pulse oximeters, a pneumatic, mechanical ventilator, suctioning devices, backboards, splints, neck-stabilization collars, lactated-ringers intravenous fluids, and dressings were used during the mission. Other supplies and equipment available were not used. Medical equipment that was said to be missing included a defibrillator, oxygen masks for children, inhalation masks and inhalation medicine, megaphones, and chamber pots.

*Time course*—The time interval from the landing of the first aircraft to the last supine patient leaving Kenya was 5.5 hours.

	Medical equipment	Used	Not used
Medical equipment	Oxygen tanks	X	
	NIBP measuring device, ECG, and pulse oximeters	X	
	Electrical mechanical ventilators		X
	Pulse oximeters	X	
	Pneumatic mechanical ventilators	X	
	Electrical suction devices		X
	Back boards	X	
	Thomas splints	X	
Supplies	Neck collars	X	
	Fluids (lactated ringer)	X	
	Bandaging material	X	
	Intubation sets		X
	Chest tube sets		X
	Central venous catheter sets		X
	Surgical airway kits		X
	Basic surgical sets		X
	Venous cut-down sets		X
Blood products	Nasogastric tube sets		X
	Urethral catheter sets		X
	Blood packs		X
	FFP		X
	Factor VII		X

Marmor © 2005 Prehospital and Disaster Medicine

**Table 4**—Medical equipment and its usage (NIBP = non-invasive blood pressure; FFP = fresh frozen plasma; ECG = electrocardiograph)

A C-130 aircraft, which evacuated most of the patients, was on the ground for 2.5 hours. The recumbent patients were repatriated by the slower C-130 planes, due to a lack of available infrastructure in the jet aircraft (Table 5).

*Operational strategy*—A forward team, including five physicians (Table 3), was sent to Kenya immediately following the event. They traveled to Kenya by means of a commercial flight. The team was experienced in gathering information on the medical status and requirements of the casualties and for organizing the transportation for the patients to the airport. The team carried medical resources thought not to be available in local facilities, specifically, factor VII and biological glue. On the ground, there was a medical command post that coordinated the transfer of patients from the different hospitals to the landing field. The transfer was done by local medical crews, with their appropriate medical supervision. Social workers treated 30 victims with anxiety, and helped other civilians cope with the tragic event. Nurses provided medical supervision during the flight.

Time	Event
<b>28 November</b>	
07:00	Explosion in hotel "Paradise Mombassa"
08:30	Beginning of preparations in the IDF medical corps
14:00	Planes and crew ready for loading of equipment
14:30	Final briefing and adaptation of crew and equipment to the planes
15:15	Briefing and vaccination of mission crew
17:00	Planned take-off for Kenya
19:00	1 <sup>st</sup> Boeing takes off
19:20	Last C-130 takes off
<b>29 November</b>	
00:15	1 <sup>st</sup> Boeing lands in Kenya
01:18	Boeing planes land in Kenya
03:35	Boeing takes off to Israel with nine mildly wounded civilians, three corpses, and 70 passengers
04:30	C-130 plan takes off with 76 passengers
05:45	C-130 plane takes off with nine mildly wounded civilians, three moderate, and one severely injured person and families of wounded = 43 total
06:00	3 <sup>rd</sup> C-130 plane takes off with 80 passengers
06:50	2 <sup>nd</sup> Boeing takes off to Kenya
07:20	4 <sup>th</sup> C-130 plane takes off with cargo
08:53	Boeing lands in Israel
12:00	1 <sup>st</sup> C-130 lands
13:35	2 <sup>nd</sup> C-130 lands with wounded
13:40	Planes start landing in Israel and dispersion of the wounded to hospitals via ambulances is done

**Table 5**—Mission schedule (IDF = Israeli Defense Forces)

**Discussion**

The Mombassa mission was organized hastily. The crew, equipment, and mode of operation were determined according to guidelines previously established by regular, fixed-wing, medical evacuation missions, and by on-site decision-making. Based on the mission results, the standard of operation for future missions were refined and set.

*Medical needs*—The distribution of injuries was typical of those expected from an explosion mechanism of injury.<sup>4</sup> Despite the expected distribution, information on the injuries should be sent to the responding teams by the forward team to aid in the preparation of the repatriation planes and personnel.

*Resources utilized*—There always is some difficulty in responding to the desire to take as many skilled medical team members as possible compared to the limited capacity of the aircraft. Therefore, it is necessary to select the lowest possible number of the correct medical team members for the task. The forward team should include surgical trauma specialists familiar with inter-hospital triage and patients with multiple traumatic injuries. Ideally, the team

Type of healthcare personnel	Number
Type of healthcare personnel	1
Team leader (flight surgeon)	1
Medical organization officer	2
Intensive care specialist	1
Trauma surgeon	1
Pediatric trauma surgeon	4
Advanced Life Support caregiver	4
Nurses	4

Marmor © 2005 Prehospital and Disaster Medicine

**Table 6**—Type and number of healthcare personnel

	Type of equipment	Severely injured	Mild-moderately injured
Medical equipment	Backboard and cervical collar	1	1
	Hypothermia kit	1	1
	Monitoring devices	1	1
	Electrical ventilator	1	1 for six
	Monitor-defibrillator	1	1 for six
Supplies	Oxygen (liters)	6,500	6,500 liters for six
	IV fluids (liters)	10	10 liters for six
	Packed blood cells (units)	2	-

Marmor © 2005 Prehospital and Disaster Medicine

**Table 7**—Recommended medical equipment for repatriation flights (IV = intravenous)

Natural catastrophe	Terrorist attack	
Forward team Rescue team Preset repatriation team	Tailored repatriation team	Local medicine—western standards
Forward team Rescue team Preset repatriation team	Forward team Preset repatriation team	Local medicine—developing

Marmor © 2005 Prehospital and Disaster Medicine

**Table 8**—Operational strategies for repatriation missions

also should include a pediatric trauma specialist and a trauma specialist familiar with the problems associated with aero-medical evacuations. In the Bali air-rescue operation, information regarding the distribution and severity of the casualties only was provided upon arrival to the disaster site.<sup>3</sup> In the Mombassa mission, the forward team was able to send a detailed account of the number and type of casualties to the transport team, as well as organize the transport of some of the patients to the airport.

Air repatriations usually are performed between hospitals. Thus, the need for prehospital emergency care rarely emerges. Immediately life-threatening conditions and emergency surgery usually have been performed prior to repatriation efforts. Therefore, the skills most needed by

the forward team usually are those required in an intensive care unit setting.

It was decided to use one intensive-care physician for every two multiple trauma or mechanically ventilated patients and one trauma surgeon for every six mild-moderately injured patients.

Despite the relatively high percentages of mildly injured patients as well as un-injured, anxious civilians stress the need for more nursing staff and fewer paramedics. Nevertheless, the use of paramedics for transporting patients from the hospital to the airfield was judicious. Repatriation teams now use an equal number of nurses and paramedics. There is a need for all team members to be trained in air-medical evacuation. For this Mombassa mission, less than half of the team members had been trained in air-medical evacuation. This lack of training caused a misuse of equipment, cumbersome work on the aircraft, and eventually reduced the quality of care during air-transport. In future missions, only trained team members will be included. The recommended medical crew for a repatriation flight with four severely injured patients and up to 12 moderately injured patients is listed in Table 6.

Due to what eventually turned out to be the relatively mild nature of the injuries in this mission, most of the medical equipment provided was not used. Despite this, it was clear that too much equipment was taken. In the Bali disaster, on the other hand, the large amount of severely injured civilians forced the team to call on the local hospitals in Sydney to lend medical equipment to the mission.<sup>3</sup>

Thus, it was clear that the type and amount of medical equipment taken on such missions should be tailored to the specific needs associated with the assignment, and to the expected number, needs, and severity of the casualties. A basic key for calculating the type and amount of medical equipment needed for future missions was formulated and is in Table 7. Planning should be done. The capacity of the plane ultimately will govern the number of patients and amount of equipment flown. The first plane(s) should be built according to the preset assumptions. The responding aircraft should be tailored according to the information gained by the forward team.

Of the six planes that flew to Mombassa, only two were used for repatriations of the casualties. Given the number and type of casualties, one evacuation aircraft could have been used. The Boeing planes (jet) were superior to the C-130s (turbo-prop) in respect to the flight times (5:35 hours versus 7:55 hours) and convenience of the patients and

medical crew. According to these observations, future planning for mass medical repatriation missions should focus on the selection and training of the medical team of the forward and evacuation teams. The platforms built should be based on the use of jet aircraft, and the mission crew should include personnel in the most appropriate specialties.

The forward team, while playing a central role, did not have treatment capabilities in Mombassa. It is recommended that in the future they be equipped with blood products, as well as critical care medicine (e.g., biological glue, factor 7), which may not be available in local medical facilities.

*Time course*—The decisions to repatriate the injured Israelis in Mombassa, as well as the beginning of the preparations for the mission of the Israeli Defense Forces (IDF) were swift. However, following the decision to repatriate, it took 12 hours for the first evacuation plane to take-off for Kenya. Causes for delay included the need to select the mission crew from a multitude of potential participants, as well as the lack of specific guidelines for preparation for such a mission. Having a defined crew as well as an agreed procedure for such missions will shorten the future response time.

*Operational strategy*—The basic operational mode used for the Mombassa mission proved worthy. The forward team members were able to communicate the medical condition of the patients and decide whether the patients could survive the journey home. The use of nurses and social workers benefited the mild to moderately injured, as well as the family members casualties. The local medical facilities were able to accommodate and administer initial treatment to the moderately and severely injured. This scenario is typical of terrorist events, as opposed to natural catastrophes, in which local medical systems collapse. In places where western medicine is practiced, prehospital care will not be needed, and there will be no need for a forward team. Four different medical repatriation scenarios are recognized, each of which requires different preparations (Table 8).

## Conclusions

A successful mass medical repatriation mission provided by the Israeli Army was studied. Large amounts of resources were utilized for an event that produced relatively little medical need. Based on this experience, a new mode of operation for similar future missions was formulated.

## References

1. Dewhurst AT, Farrar D, Walker C, *et al*: Medical repatriation via fixed-wing air ambulance: A review of patient characteristics and adverse events. *Anaesthesia* 2001;56(9):882-887.
2. Patel D, Easmon CJ, Dow C, *et al*: Medical repatriation of British diplomats resident overseas. *J Travel Med* 2000;7(2):64-69.
3. Hampson GV, Cook SP, Frederiksen SR: Operation Bali assist. *Med J Aust* 2002;177(11-12):620-623.
4. Kluger Y, Kashuk J, Mayo A: Terror bombing-mechanisms, consequences and implications. *Scand J Surg* 2004;93(1):11-14.