CASE STUDY

Mexico City's Petroleos Mexicanos Explosion: Disaster Management and Air Medical Transport

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Abstract

Mexico City is the largest metropolitan area in the Americas and 1 of the largest in the world; its geographic location and uncontrolled population and industrial growth make this metropolis prone to natural and human-made disasters. Mass casualty disaster responses in Mexico City tend to have complications from multiple logistical and operational challenges. This article focuses on the experiences and lessons learned from an explosion that occurred in a government building in Mexico City and the current status of mass casualty disaster risks and response strategies in Mexico City as well as air medical evacuation, which is a critical component and was shown to be extremely useful in the evacuation of 15 critically ill and polytraumatized patients (Injury Severity Score > 15). Several components of the public and privately owned emergency medical services and health care systems among Mexico City pose serious logistical and operational complications, which finally will be addressed by a joint emergency preparedness council to unify criteria in communications, triage, and incident/disaster command post establishment.

Introduction

Large metropolitan areas pose a serious challenge for emergency medical services (EMS). Mexico City is unique in many aspects from an EMS standpoint. According to the 2010 census, the metropolitan area, which is composed by 16 boroughs in Mexico City and 41 municipalities of the states of Mexico and Hidalgo, has a population of over 20 million people, making it the largest metropolitan area in the Americas and 1 of the largest in the world.[1]

Mexico City is no stranger to mass casualties. A variety of natural and human-made disasters have affected the city for decades, showing its high vulnerability.[2] In the past 30 years, several disasters ranging from earthquakes to chemical explosions and even volcanic eruptions have occurred.[2,3]

In 1984, in a liquefied petroleum gas warehouse owned by Petroleos Mexicanos (PEMEX) in San Juan Ixhuatepec (part of the municipality of Tlalnepantla, which forms part of Mexico City's metropolitan area), a series of 16 boiling liquid expanding vapor explosions occurred in a period of 90 minutes.[4] Two of the explosions had an intensity of 0.5 on the Richter scale.[4,5] The facility had 6 storage spheres and 48 horizontal cylinders with an overall capacity of 16,000 cubic meters.[4] The terminal was totally destroyed, and fatality estimates ranged from 500 to more than 600 and injury estimates ranged from 5,000 to 7,000.[5]

The second tragedy was in 1985 when an earthquake occurred in the coasts of the Guerrero and Michoacan states of Mexico with an intensity of 8.1 on the Richter scale.[6] It affected Mexico City, destroying parts of the General Hospital of Mexico and several apartment buildings, hotels, and towers. One of the authors was an intern at that time in 1 of the hospitals that was destroyed by the earthquake (JV). Fatality estimates ranged from 3,000 to 4,000, and injury estimates ranged from 10,000 to 50,000.[6-8] From a logistic standpoint, Mexico City's police department controls the largest number of ambulances via the Medical Emergencies and Rescue Squadron, followed by the Mexican Red Cross, the Medical Emergencies Regulation Center, and several private ambulance services. The only helicopter emergency medical services (HEMS) throughout Mexico City is controlled by the police department. Recently, these EMS were used in a large explosion at a building complex of PEMEX, the government-owned petroleum company, with many casualties. We report on such events.

Case Report

Sequence of Events

On January 31, 2013, at 15:45 Central Standard Time (CST), an explosion allegedly caused by a gas accumulation

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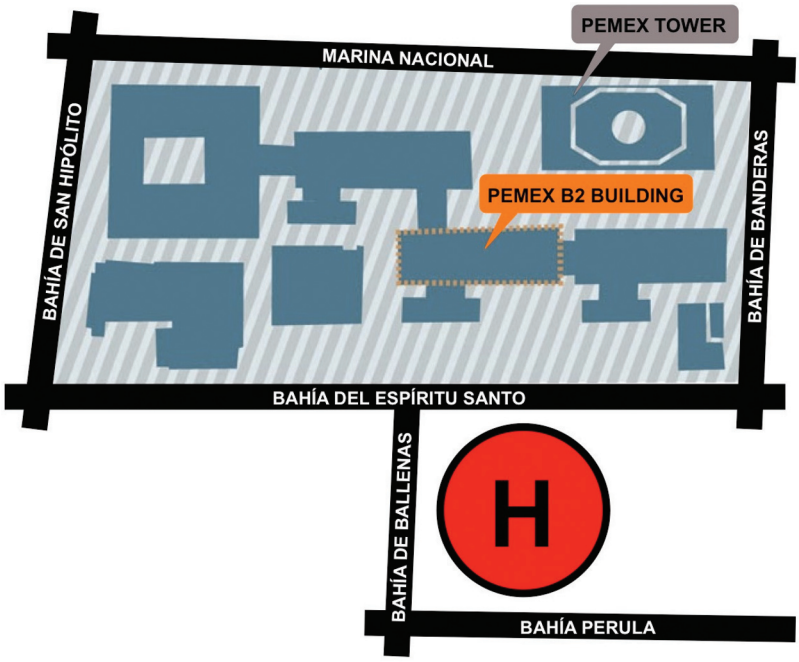
Figure 1. A map of the PEMEX's executive complex and the adjacent parking lot where the improvised heliport was established (marked with an H in a red circle) is shown.



occurred between the basement and the first floor of the B2 tower of the PEMEX's Executive Complex, the third tallest building in Mexico (Fig. 1). This explosion was followed by an "earthquake-like" shaking that was felt several blocks around the explosion site. At 16:20 CST, a full evacuation of the entire executive complex was finished; about 10,000 persons work among all the buildings of the complex, including the 214-m (54-story) building. Figure 2 shows a sequence of the events.

The police department's HEMS was called to the site at 15:50 CST, and the first helicopter arrived at the scene at 16:00 CST. There was no approved landing site on the scene, so the first 2 helicopters (a Bell 412 SP and a Bell 206 B-3) landed in an adjacent full parking lot just in front of the B2 building (Fig. 1); thereafter, the cars were removed from the parking lot where an improvised heliport was set up. A total of 5 ambulance helicopters arrived on the scene. Table 1 depicts the characteristics of each helicopter and the emergency transport capabilities.

Several government and nongovernmental organizations participated in the search and rescue of victims. Among them, Mexico City's police department HEMS "Cóndores," Mexico City's police department special weapons and tactics team "Zorros," Mexican Red Cross, Mexican Army, Mexican Navy, Mexican Federal Police, urban search and rescue teams, collapsed structure search and rescue teams, and several others.

The Police Department HEMS uses the simple triage and rapid treatment (START) triage algorithm for prioritizing transport in multiple victim disasters. START triage was developed in 1983 by the Newport Beach Fire and Marine Department and Hoag Hospital in Newport Beach, CA, and uses a simple procedure to assess respiration, perfusion, and mental status; then, the victims can be assigned into any of 4 triage categories: expectant black tag, immediate red tag, delayed yellow tag, or minor green tag.[9]

As soon as the victims were taken out from the debris of the building, they were transferred to a triage post placed adjacent to the improvised heliport, where the patients with red tag (immediate) and some patients with yellow tag (delayed) were evacuated via helicopter.

Because all the victims were PEMEX's employees and outsourced personnel, most critical patients were transported to the Central PEMEX Hospital "Picacho" in southern Mexico City; however, their helipad was not in service, and the patients were taken to the closest helipad available, which was at Angeles Pedregal Hospital, a privately owned hospital in Mexico City that is not routinely used to attend multiple victim disasters. Therefore, it was soon flooded by critically ill patients, and medical personnel and equipment, such as stretchers, became insufficient. Both hospitals responded to this catastrophe in an attempt to attend all the patients arriving to their emergency departments.

Several hours after the initial explosion, urban search and rescue teams and collapsed structure search and rescue teams were still working on the collapsed structures and were able to find 1 victim still alive. After the extrication, the victim was airlifted and evacuated by the police department's HEMS. Special care was given to this victim because he developed crush syndrome; the patient was discharged without kidney injury.[10]