SHORT COMMUNICATION

Trend of Elevator-Related Accidents in Tehran

Ali Khaji, MD; Syyed Mohammad Ghodsi, MD

Research performed at Sina Trauma and Surgery Research Center, Sina General Hospital, Tehran University of Medical Sciences, Tehran, Iran

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Abstract

Background: Elevator-related accidents are uncommon, but can cause significant injury. However, little data exist on these types of accidents. To compile and analyze accident data involving elevators in an effort to eliminate or at least significantly reduce such accidents.

Methods: In this retrospective study we investigated 1,819 cases of elevator-related accidents during a four-year period (1999-2003) in Tehran. The data were obtained from the Tehran Safety Services & Fire Fighting Organization (TSFO) that is officially and solely responsible to conduct rescue missions of civilians in Tehran.

Results: The number of elevator accidents has increased steadily during the four year study period. During these four years there was a positive upward trend for serious injuries and mortality resulting from elevator accidents. Technical problems were the main cause with 74.5%, followed by power loss and overcapacity riding with 11.5% and 7.9% respectively. Sixty-three individuals sustained serious injury and 15 people died as a result of elevator accidents. The number of accidents was significantly higher in summer (x2=18.32, P=0.032) and a considerable proportion of incidences (54%, 947 cases out of 1819) occurred between 5 and 12 pm.

Conclusions: Establishment of an organization to inspect the settings, maintenance, and repair of elevators is necessary.

Key words: Elevator, Elevator-related accidents, Mortality, Serious injury, Tehran

Introduction

An elevator is a lifting device, equipped with a passenger-carrying unit that moves vertically on guides, which serves two or more floors of a building or structure. Elevator-related accidents are uncommon, but can cause significant injury (1, 2). In recent decades, the number of elevators has increased along with the number of large cities and their populations. Annually, several people die and more are injured due to elevator accidents. For example, accidents involving elevators and escalators kill about 30 and seriously injure about 17,100 people each year in the United States (1, 3). Tehran is a highly urbanized city with a population of nearly 8 million and in recent years, vertical living is becoming more common following the increase of high-rise building construction (4). After evaluating several elevator accident reports by the Tehran Safety Services & Fire Fighting Organization (TSFO), we became interested in investigating this unusual mechanism of injury. The compilation and analysis of accident data involving elevators is of great importance so that such accidents can be eliminated or at least reduced.

Materials and Methods

This is a retrospective study and the data were obtained from TSFO. This organization has the most reliable source of elevator-related accident data because it is solely and officially responsible for civilian rescue missions in Tehran and it has more than 100 first aid stations around Tehran.

To achieve the study objective, the main variables studied were gender, age, date and time and cause of accident (according to TSFO experts' opinions), number of elevator passengers, number of serious injury probability (those injuries that were substantial enough to limit activity or to require the attention of a medical professional), and deaths of passengers or fire-fighters. SPSS for windows (version 10) was used for data analysis and a=0.05 was considered as statistically significance.

Corresponding Author: Ali Khaji, Sina Trauma and Surgery Research Center, Sina General Hospital, Tehran University of Medical Sciences, Tehran, Iran.
Email: akhaji@razi.tums.ac.ir

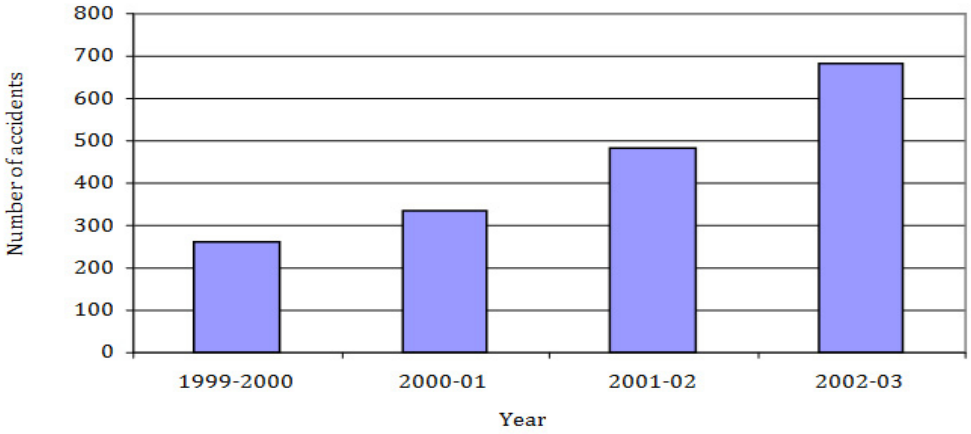

Figure 1. Trend of elevator-related accidents in Tehran between March 1999 and 2003.

Results

During these four years (21 March 1999 to 20 March 2003), TSFO received reports of 1,819 accidents involving elevators in Tehran that involved 3661 people. The sample comprised of 2,254 (61.5%) males and 1,409 (38.5%) females and males outnumbered females in all age groups, with the male to female ratio of 1.6 to 1. Also, nearly 57% of the people involved in an elevator accident were less than 30 years old. The reports have also shown an upward trend in the number of elevator accidents, which has increased steadily since 1999 (Figure 1). The mean number of elevator passengers was 2.01 (range: 1-8). Number of serious injuries and mortality resulting from elevator accidents has also shown a positive upward trend during the four year study period (Figure 2). Overall, 63 individuals sustained serious injury (Figure 2). From them, 10 (15.9%) were females and 53 (84.1%) were males. Furthermore, during the study period, 15 people died as a result of elevator accidents, among them 11 (63.3%) were males and four (26.7%) were females (Figure 2). The main cause of elevator accidents was due to technical problems with 1311 reported accidents (72.1%), followed by power loss with 209 (11.5%) and overcapacity riding of passengers with 144 (7.9%) (Figure 3). Other causes comprise 5.2 % (95/1819) of reported accidents and the cause in 60 (3.3%) reports was unknown. The mean time of the dispatch-beginning-to-scene-arrival interval of fire-fighting crews was 20 minutes. In 16.9% (307/3661) of accidents, untrained, and unauthorized personnel tried to intervene before the arrival of fire-fighting crews. For nearly 48.2% (148/307) of these attempts, the situation became worst following their intervention. Tehran consists of 22 municipal districts. Twenty percent of these incidents happened in the sixth district, which has the majority of public buildings and government offices. Moreover, the number of accidents was significantly higher in summer (x2=18.32, P=0.032), a considerable proportion of accidents (54%, 947/1819) occurred between 5 pm and 12 pm, and these types of accidents mostly occurred on Sunday and Tuesday (16%).

Discussion

Our results have shown a significant positive upward trend of elevator accidents, from 271 incidents in the first year to 689 in the fourth, contrary to reports. According to other reports (from North America) the number of accidents related to elevators in operation has remained

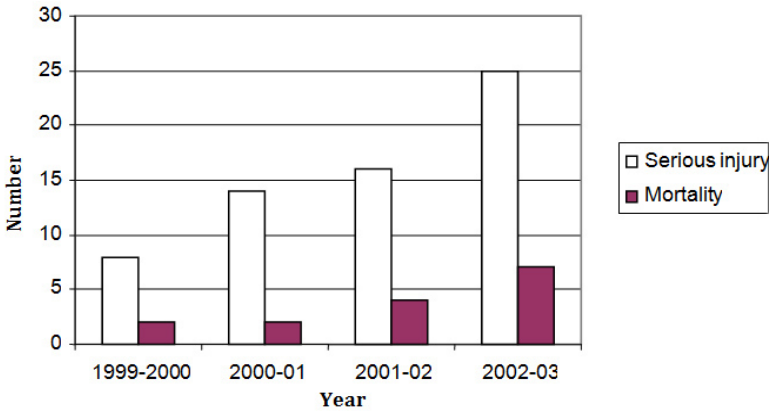

Figure 2. Number of mortality and serious injury due to elevator-related accidents in Tehran between March 1999 and 2003.

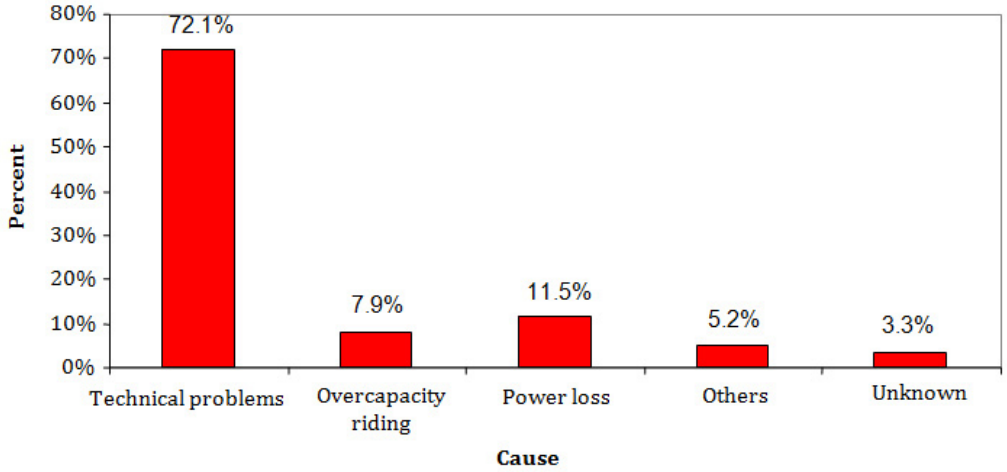

Figure 3. The causes of elevator-related accidents in Tehran between March 1999 and 2003.

relatively stable over recent years in relation to the increase in the number of elevators (5).

In an annual report of Technical Standards & Safety Authority (TSSA) the cause of 61% of all elevator accidents reported in 2002 (99 out of 162) was attributed to factors related to device maintenance inadequacies and/or device malfunctioning (5). Less than one-third (31%, or 51 out of 162 accidents) was attributable to passenger-related factors. Magnus reviewed the reports of elevator-related accidents during a 23-year period (1975-1998) and shown that the main cause for elevator accidents was the absence of a car door, preceded by falling into the elevator shaft (6). According to data provided by the U.S. Bureau of Labor Statistics and the Consumer Product Safety Commission, the two major causes of death in elevator/escalator accidents were falls and being caught in/between moving parts of elevators/escalators (7,8). In our study technical problems (device malfunction or poor maintenance) with 74.5% was the main cause of elevator accidents. The reason might be attributed to the circumstance of elevator maintenance and construction. Many of the elevators in use in Iran have been imported from European, North American or Asian companies. Unfortunately, the spare parts that are used for elevator repair or maintenance are sometimes acquired from companies different from the original manufacturers. Furthermore, some of the elevators in use are assembled in our country; meanwhile their parts are obtained from different companies. Consequently, the parts may not match and eventually may lead to technical problems and accidents. So, considering this issue, the spare parts of imported or domestically assembled elevators must be obtained from the main manufactures in order to prevent malfunctioning problems that can lead to elevator –related accidents. In addition, periodic inspections of operating elevators can also prevent these types of accidents.

Power loss (11.5%) was the second cause of elevator accidents in our study. Using emergency generators is the best option to reduce incidences resulting from power loss. Finally, in relation to elevator accidents due to carrying more passengers than capacity allows (7.9%), education programs for people could be the main method to prevent accidents.

Unfortunately, in Iran there is not a special organization to handle and investigate elevator accidents. So, if injuries or death occurs due to elevator accidents, determining responsible is impossible. Perhaps building managers/owners, service companies, manufactures and so on could be held responsible, but in absence of regular inspections, it is difficult to determine actual responsibility. Hence, the establishment of an organization to inspect the settings, maintenance, and repair of elevators also seems to be necessary.

The first step to prevent further elevator accidents is the establishment of an organization that includes necessary specialists to inspect elevator settings, maintenance, and repairs. This organization should implement a periodic inspection program, in which factors such as device history, equipment utilization and spare parts are investigated. Moreover, spare parts must be obtained from the original manufacturers. Also, educational programs could improve the safety habits of passengers and in case of actual accidents, the intervention of untrained and unauthorized personnel is dangerous and must be discouraged and prevented. Finally, other safety policies that should be enforced are requiring emergency generators for buildings with elevators.

Ali Khaji MD
Syyed Mohammad Ghodsi MD
Sina Trauma and Surgery Research Center, Sina General Hospital, Tehran University of Medical Sciences, Tehran, Iran

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