



High Rise Syndrome: A Correlation Between Height And Affections In 45 Cats From Urban Areas

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ABSTRACT

Forty five cats of high rise syndrome were admitted to surgery clinic of Mansoura Veterinary Teaching Hospital (MVTH), over a period of 3 years (2015-2018). Cats were admitted for treatment or euthanasia after a fall or jump from a balconies or windows. These cats were admitted after varying period (one to seven days) after the fall. Cats fell from the height of the 2nd to the 5th floor. Their ages were ranged from 3 months to 4 years. Each cat was clinically examined; in addition to that ultrasonographical, radiological and neurological tests were performed. After diagnosis and consultation with the owner a decision was taken for either conservative, surgical treatment or euthanasia. Fractures of the limbs and joint dislocations were seen in 60% (27/45), vertebral fracture 11.1% (5/45) spinal luxation in 6.7% (3/45), Oro-facial injuries in 4.4% (2/45) and head trauma in 17.8% (8/45). Shock was diagnosed in 62.2% (28/45) and survival rate was recorded in 77.8% (35/45). The mean height of fall for the euthanized and dead cats was 2.5 floors (range 2nd to 3th floors). This study founded a relation between types of injuries and the height of the fall where falling from lower floor is more risky and resulted in more dangerous problems than that of higher one.

1. INTRODUCTION

Feline high-rise syndrome is a collection of traumatic affections sustained by cats that falling from windows or balconies of high-rise buildings in urban areas. As described by Robinson (1976), the minimal height of the fall being the second floor. In most cases, the cause of the fall is related to play when the animal jumps from the window or over the balcony, when chasing a bird or insect, or slipping whilst walking on the edge of the balcony railing or window (Whitney and Mehlhaff, 1988; Dupre et al., 1995; Flagstad et al., 1998 and Papazoglou et al., 2001). It is characterized mainly by a triad of injuries concerning the face, thorax and extremities (Kapatkin and Matthiesen 1991 and Thacher 1993).

High-rise syndrome has also been recorded in dogs (Gordon et al., 1993) and humans, when the terms “jumpers syndrome” or “high-flyer syndrome” are also used (Reynolds et al., 1971; Smith et al., 1975; Dupre et al., 1995 and Pratschke and Kirby, 2002). Few retrospective studies are currently available and are at variance about conclusion. Some authors have reported that the relationship between the height of fall and the severity of the injuries follows a curvilinear pattern (Flagstad et al., 1998 and Papazoglou et al., 2001), whereas Dupre et al., (1995) postulated a linear increase of the number of injures with the increasing height of the fall.

This retrospective study of 45 high-rise syndrome cats reports the frequency, the extent and the type of traumatic injuries sustained by these cats. Also report the relationship between the type of injuries and the presumed heights of the falls in a different environment in Egypt.

2. MATERIALS AND METHODS:

The medical records of 45 cats -that sustained free falls from high-rise apartment buildings in different locations at Dakahlia state, Egypt and surrounding rural areas and were admitted to Mansoura Veterinary Teaching Hospital were recorded over a period of 3 years (2015-2018). The gender, the age, of the cats as well as the number of the floors from which the cat had fallen were recorded. Clinical, ultrasonographical and radiographical examination and neurological tests were performed for each cat. The type of injuries and the applicable treatment and survival status at the time of discharge from the hospital were recorded.

Aside from specific repair of the traumatic injuries; treatment for the vast majority of trauma patients was supportive. Cardiovascular shock was diagnosed and was resuscitated accordingly with emergent oxygen therapy and colloidal and crystalloid fluids under continuous monitoring till animals become close to normal healthy parameters. After the abnormalities have been encountered non-steroidal anti-inflammatory ketoprofen (1-2 mg/kg IM/ q24h for 5 days) was used after animal stabilization.

Fractures management was accomplished according to (Binnington and Miller, 1997; Sardinas and Montavon, 1997; Bruce, 1998; Probst, 1998 and Nakladal *et al.*, 2013) either by open reduction and fixation using either appropriate intramedullary bone pinning in cases of transverse (n=6) and short oblique (n=7) stable fractures, while in 4 cats with unstable comminuted fractures, fixation was obtained by application of bone plates. Both femoral (n=3) and tibial physeal (n= 4) fractures were managed by open reduction and application of Kirschner wires.

Cats with oro-facial affections underwent surgical repairs along with conservative treatment. The cat with oro-nasal fistula and split in the hard palate (Fig. 1) had surgical repair using a unilateral inverting mucosal flap and a unilateral sliding mucosal flap

(Becker *et al.*, 2003, Tobias, 2010 and Bonner *et al.*, 2012). Antibiotics and soft diets were prescribed for successive 5 days.

3. STATISTICAL ANALYSIS

Data were collected, organized and analyzed using software SPSS version 16.0 (SPSS Inc, USA). Chi square test was used to test the relations between the number of floor with the type of affection and the fate of fallen cats, and the relation between gender with both the fate and the type affection. (A P value of less than 0.05 was considered statistically significant and that of less than 0.00 was considered statistically highly significant).

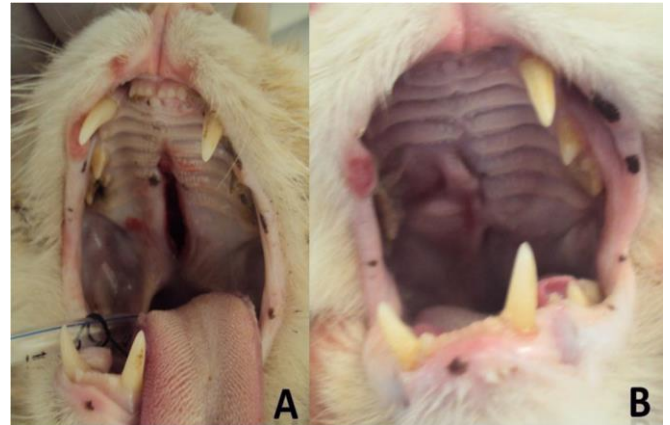


Fig. (1): A cat of high-rise syndrome with oro-nasal fistula and split in the hard palate before, A; and after, B operation.

4. RESULTS

During the period of 3 years, 45 cats were diagnosed with several injuries after falling from a height (Table 1 and Fig. 2). The mean (\pm SD) falling floor was 3.7 (\pm 1.06) with range (2nd to 5th) floor. The mean (\pm SE) age of the 45 cats was 19.6 (\pm 1.67) months (range 3 to 48 months) where, 48.8% of the cats were less than one and half year old. Sixty percent of the cats were entire males, 15.6% were intact females and 24.4% were castrated males. The mean age of castration was 15 months (range 9-29 months). No cats were pregnant at the time of fall. Shiraz cats were dominant with a percent of 68.9%, Siamese with 24.3% and Egyptian Mau with 6.7%. All but two cats landed on hard ground. These two cats with oro-facial injuries landed on trees. All cats were presented in warm moths

(March- November).Thirty eight cats (84.4%) fell during daytime.

Table (1): high rise syndrome affections per each floor

Floor	Affections	Number of affections
2 nd	Head trauma	4
	vertebral fracture	3
3 rd	Head trauma	4
	shoulder dislocation	1
	vertebral fracture	2
	spinal luxations	3
	fascial injuries	1
	Oronasal fistula	1
4 th	luxation of radial carpal bone	1
	distal tibial physeal Fractures	3
	femoral mid shaft fracture	6
	distal Femoral physeal fracture	1
	radius and ulna mid shaft fracture	2
5 th	distal Femoral physeal fracture	2
	radius and ulna mid shaft fracture	5
	femoral mid shaft fracture	4
	shoulder dislocation	1
	distal tibial physeal Fractures	1

There was a highly significant relationship between the number of the falling floor and the type affection (chi square = 44.7, $P = 0.000$). 96.3% of limb and joint affections were observed in the 4th (13/27) and 5th (13/27) floors. Meanwhile, head, facial and spinal injuries were observed in the 2nd (7/45) and 3rd (11/45) floors. There was a highly significant relationship between the falling floor and the fate of fallen cats (chi square = 22.115, $P = 0.000$), where the euthanized and dead cats (10/45) were observed in 2nd (7/10) and 3rd (3/10) floors. The mean height of fall for the euthanized and dead cats was 2.5 floors (range 2nd to 3th floors). Gender had no significant relationship neither with the affections ($P = 0.544$) nor with fate ($P = 0.565$).

Among the presented falling cats; twenty-eight cats (62.2%) required emergency treatment for shock included aggressive intravenous administration of crystalloids, colloids and corticosteroids. Surgery was performed in (26/45) cats; 24 had orthopaedic surgery and two underwent soft tissue surgery. Within 4 hours of admission and because of the poor prognosis and for humane reasons owners preferred euthanasia in 8 cats with vertebral fractures (5/45) and head trauma (3/45). Survival rate was 77.8% (35/45) cats.

On radiography, limbs and joint affections were seen in 60% cats (27/45). Of these 27 cats (44.4%) were less than one year old. Thirty seven percent of

these 27 cats had forelimb affections as (7/27) cats had radius and ulna mid shaft fractures, 2 cats with shoulders dislocation and a cat with luxation of radio-carpal joint. The reminder cats (17/27) with hind limb fractures included femoral mid shaft fracture (10/27), distal tibial physeal fractures (4/27) and distal femoral physeal fracture (3/27).

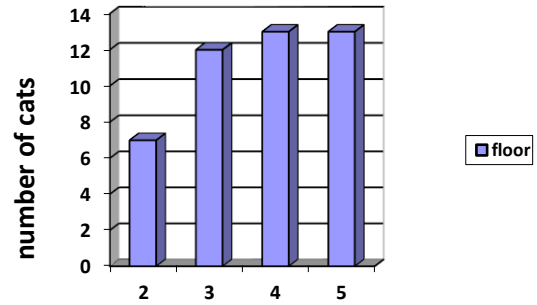


Fig. (2): Showing the relation between the floor height and the distribution of cats with high-rise syndrome.

Eight (17.8 %) of the admitted cats sustained lumbar spinal trauma with vertebral fractures 11.1% (5/45) or spinal luxations in 6.7% (3/45). These cats fell from heights of the 2nd or the 3rd floor. Cats with spinal luxation were treated conservatively with an initial dose of methyle-prednisolone succinate 30 mg/kg IV bolus injection followed by 15mg/kg at 2 and 6 hours and then an IV infusion of 2.5 mg/kg/hour for 24 hours, then they sustained on daily supportive treatment and a dose of methyle-prednisolone. Cats with vertebral fractures were euthanized due to poor prognosis and financial limitations. Injuries in cats with oro-facial affections (2/45; 4.4%) healed within 5 days. Head trauma was observed in 8 cats (17.8%), three of them with globe proptosis and epistaxis were euthanized according to owner will and the others five were treated conservatively. Despite great efforts to stabilize them, two died within the first 48 hours following the fall of the remaining 5 cats.

5. DISCUSSION

Cats have no seven lives and can't take care of themselves as Egyptian thinks. The truth is that cats are of high risk to injury as other companion animals when fall accidentally from high-rise windows and balconies. Many low-educated owners don't realize the danger from putting their pets on the floor or balconies which are conducive to pets falling especially at low heights. Cats have an incredible ability to focus their attention on whatever interests them. A bird, insects or

other animal attraction can be distracting enough to cause them to lose their balance and fall. Pets don't have the same sense of danger that people have and are easily enticed by things they see outside and the results can be catastrophic. The incidence of high rise syndrome remains unknown, but it is likely to be more common than reported. Not only can a fall be harmful to the pets, it can also be very costly for their owners.

As defined by Robinson (1976) feline high-rise syndrome is characterized as a fall from the second floor or higher. In the city of Mansoura the most high-rise apartment buildings are no higher than eight to eleven floors. The mean height from which cats fell was 3.7 floors (2nd to the 5th floor) this was lower than that reported by Whitney and Mehlhaff, 1988 (5.5 floors; range 2 to 32 floors) but similar to studies by Flagstad et al. 1998, (3.1 floors; range 1 to 8 floors), Gordon et al., 1993 (2.8 floors; range 1 to 6 floors) and Papazoglou et al., 2001 whose (79%) cats fell from heights that ranged from the 2nd to 4th floor.

In Mansoura city and in the presence of many cars parking along the narrow streets under the building, hard rubbish, electrical cables, and trees may increase the risk of injuries from the fall. Cats may actually be at greater risk for injury when falling from shorter distances as well as mid-range or higher altitudes (Kinnear, 2006). Although cats have well developed vestibular system in the inner ears that unusually keen sense of balance, these results found a significant relationship between the falling floor and the type affection. Shorter distances do not give them enough time to adjust their body posture to fall correctly, so head, facial and spinal injuries were observed after fall from the 2nd and 3rd floors. The longer the fall the more time the cats reposition their heads, arch their backs and spread their legs into an umbrella shape to ensure that they land on their four paws, further that the landing impact is evenly absorbed and evenly distributed through bones, joints and muscles (Kapatkin and Matthiesen; 1991, Silverstein and Hopper, 2009 and Passalacqua and Merola, 2015). So, 96.3% of limb and joint affections were observed in the 4th and 5th floors.

Due to the more behavioral activity, younger cats are more likely to fall than the adults. The mean age of the cats (1.6 years) was lower than those in the study of Whitney and Mehlhaff 1988 (2.7 years), of Dupre et al. (2.5 years) and of Flagstad et al., (2.3

years) and agreed with that of Papazoglou et al., 2001 (1.2 years). In the presented study 48% of cats were less than 18 months. Heidenberger, (1997); Vnuk et al., (2004), and Passalacqua and Merola, (2015) confirmed that younger cats (1 - 3 years of age) may be more susceptible to fall due to their increased activity, play or aggressive behavior or due to their relative inexperience with hazards, particularly in new or unfamiliar environments.

Because in cold weather the windows and balconies' doors were almost closed and cats mostly spend most the time inside the apartment. So in this study, cats fallen between March- November, this confirm that high-rise syndrome was observed and more frequent during warmer months in temperate climates (Nakladal et al., 2013). Time of day is an important factor that must be included in researches - particularly in conjunction with seasonal effects. In this study the percent of the fallen cats during daylight (84.4%), was more than that of Whitney and Mehlhaff, 1988 (60%). Many low-educated owners don't realize the danger from putting their pets on the floor or balconies which are conducive to pets falling especially at low heights.

Gender had no significant relationship, neither with affections nor with survival rate. In this study 24.4% of the cats were castrated males. In a study of Papazoglou et al., (2001) only 2% of the admitted cats were sterilized meanwhile in Liehmann et al., (2011) three of the admitted four cats were castrated. Castration in cats as well as any animal is preferred in young age (2-3 months in cats) before animal adoption and before appearance of secondary sexual characters which incriminating the irresponsible behaviors leads to high rise syndrome. In this study, the mean age of castration was 15 month (9 to 29 months) and this was too old to expect change the animal behavior. No previous studies mention the correlation between both castration and the incidence of high-rise syndrome which imperative further studding.

Cats were presented to the veterinary hospital emergently following a fall. Injuries were ranged from facial injuries to severe life-threatening head injuries. Regardless of the height of the floor, the general approach and supportive care for such cases were similar and include providing analgesia, appropriate fluid resuscitation, and continuous monitoring and management of specific injuries. With appropriate

preparedness and systematic assessment of each case, the prognosis for survival is excellent. Similar results obtained by Vnuk et al. (2004).

Any evidence of head trauma requires careful handling of the patient. Stress was minimized with analgesic/sedative combinations, excessive manipulation of the head and neck or occlusion of both jugular veins was avoided, and procedures that may induce sneezing were delayed. Cats were gently restrained for procedures. Epistaxis and globe proptosis that indicated occult traumatic brain injury necessitated euthanasia in two cats according to owners well. Garosi and Adamantos (2011) mentioned that evidence of head trauma is significantly associated with mortality. Regardless intensive resuscitation, results of this study support these findings.

After fall, 60% of cats sustained fractured limbs. These incidences were similar or close to that's of Dupre *et al.*, (1995); Papazoglou *et al.*, (2001) and Vnuk *et al.*, (2004) but higher than those reported by Whitney and Mehlhaff (1988; 39%) and Flagstad *et al* (1998). As explained before this might be due to fall from high flight (4th and 5th floors) with extended limbs and the terminal velocity is achieved making the cat more prone to injury (Whitney and Mehlhaff, 1988). The proportion of fractures between the forelimbs (37%) and hind limbs (63%) was (1: 1.7) which was similar to that of Papazoglou *et al.*, (2001) and Vnuk *et al.*, (2004). This might be the clue that major cats when fall from high floors and after body reposition with limbs extension they landed firstly on hind limbs. But the dissimilar results obtained by (Whitney and Mehlhaff, 1988, Flagstad *et al.*, 1998) obligate the need for further studies.

It is interesting to note that lumber spinal trauma was seen in 17.8% of the cats, a proportion similar to that of Papazoglou *et al.*, (2001) (15%) and much higher than those detected in Whitney and Mehlhaff, 1988 (2.5%) and by Flagstad *et al* (2.4%). In the present study, cats had lumber spinal injuries fell from heights less than four floors, as these cats had no enough time for body reposition to face downwards.

Unlike Dupre *et al* (1995) and Flagstad *et al* (1998) that reported fractured palates in 11% of high-rise syndrome cats, the present study had 2.2% of fallen cats that treated successfully with surgical intervention.

In spite of the survival rate in this study (77.8%); dealing with high-rise emergencies, knowledge of the most common injuries, and the understanding of the emergency procedures necessary for treatment can dramatically improve the outcomes to 93% survival rate as obtained by Dupre *et al* (1995) and Papazoglou *et al.* (2001).

CONCLUSION

This work reviews high-rise syndrome research for the first time in local area in Egypt and highlights areas for further research as well as some considering to prevent high-rise syndrome. It was concluded that falling from lower floor results in more dangerous and causes severe trauma than that of higher ones. In spite of the emergency and routine treatment we believe as others that the following basic advice for cat owners. This includes: keeping windows closed to ensure a cat does not escape through a window, remove any furniture that would allow a cat to gain access to an open window, finally do not allow cats on to a balcony area unsupervised especially younger cats.

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