UNIVERSITI PUTRA MALAYSIA

PREVALENCE OF INJURIES ASSOCIATED WITH HIGH RISE SYNDROME IN CATS PRESENTED TO THE UNIVERSITY VETERINARY HOSPITAL (UVH), UNIVERSITI PUTRA MALAYSIA

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MUHAMMAD DZUL IKRAAM AB RAHMAN

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It is hereby certified that we have read this project paper entitled "Prevalence of Injuries Associated with High Rise Syndrome in Cats Presented to the University Veterinary Hospital (UVH), Universiti Putra Malaysia", by Muhammad Dzul Ikraam Ab Rahman and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course VPD 4999 – Final Year Project.

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LIST OF ABBREVIATIONS

HRS	=	High Rise Syndrome
SBT	=	Sindrom Bangunan Tinggi
UVH	=	University Veterinary Hospital
HVU	=	Hospital Veterinar Universiti
UPM	=	Universiti Putra Malaysia
DSH	=	Domestic Shorthair

ABSTRAK

Abstrak dari kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek Ilmiah Tahun Akhir.

PREVALENS KECEDERAAN BERKAITAN DENGAN SINDROM BANGUNAN TINGGI PADA KUCING YANG DIHANTAR KE HOSPITAL VETERINAR UNIVERSITI, UNIVERSITI PUTRA MALAYSIA

oleh

Muhammad Dzul Ikraam Ab Rahman

2015

Penyelia: Prof Madya Dr Arifah Abdul Kadir

Penyelia bersama: Dr Siti Zubaidah Ramanoon

Pengenalpastian jenis kecederaan Sindrom Bangunan Tinggi (SBT) yang lazim dapat menambah maklumat untuk pencegahan dan rawatan kecederaan SBT. Prevalens 21 kecederaan tersebut, tiga kecederaan paling lazim, dan perkaitan antara ketinggian kejatuhan dan tahap kecederaan dalam kajian ini telah ditentukan. Buku log dan kes perubatan kucing yang dihantar ke HVU, UPM dari 1 Januari 2002 hingga 31 Disember 2014 telah disemak. Kriteria kes yang dipilih telah didiagnosis dengan SBT, jatuh dari tingkat dua atau lebih, mempunyai penemuan imej diagnostik, dan mempunyai sekurang-kurangnya satu daripada 21 kecederaan berkaitan SBT dalam kajian ini. Prevalens 21 kecederaan yang dikaitkan dengan

SBT adalah patah tulang kaki (60%) (12/20), pneumotoraks (30%) (6/20), epistaksis dan peralihan tulang vertebra (20%) (4/2) setiap satu, luka, kencing berdarah, dan peralihan sendi kaki (15%) (3/20) setiap satu, dan laserasi, kontusi peparu, dan patah gigi, lelangit, pinggul, dan tulang vertebra (5%) (1/20) setiap satu. Tiga kecederaan paling lazim yang dikaitkan dengan SBT adalah kepatahan tulang kaki, pneumotoraks, dan epistaksis; kecederaan yang keempat, peralihan tulang vertebra, mempunyai prevalens yang sama dengan epistaksis. Ketinggian kejatuhan dari tingkat tiga hingga tingkat enam adalah berkait secara positif dan moderat dengan tahap kecederaan kucing yang ditimpa SBT ($r = 0.622$; $p = 0.031$; $n = 12$).

Kata kunci: Sindrom Bangunan Tinggi, ketinggian kejatuhan, kecederaan, korelasi, prevalens

ABSTRACT

An abstract of the project paper to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 – Final Year Project.

PREVALENCE OF INJURIES ASSOCIATED WITH HIGH RISE SYNDROME IN CATS PRESENTED TO THE UNIVERSITY VETERINARY HOSPITAL (UVH), UNIVERSITI PUTRA MALAYSIA

by

Muhammad Dzul Ikraam Ab Rahman

2015

Supervisor: Prof Madya Dr Arifah Abdul Kadir

Co-Supervisor: Dr Siti Zubaidah Ramanoon

The identification of common High Rise Syndrome (HRS) injuries in cats may help to fill the information gap required to prevent and treat the injuries. The prevalence of the 21 injuries, three most common injuries, and the correlation between height of fall and severity of injuries were determined in this study. Logbooks and medical cases of cats presented to the UVH, UPM from 1 January 2002 until 31 December 2014 were reviewed. The criteria used for selected cases were cats diagnosed with HRS, fell from at least the 2nd storey, had diagnostic imaging findings, and must have at least one out of the 21 injuries associated with HRS in this study. The prevalence of injuries associated with HRS in this study were

limb fractures (60%) (12/20), pneumothorax (30%) (6/20), epistaxis and vertebral luxation (20%) (4/20) each, wound, haematuria, and limb luxation (15%) (3/20) each, and laceration, pulmonary contusion, dental fractures, hard palate fractures, pelvic fractures, and vertebral fractures (5%) (1/20) each. Three most common injuries associated with HRS were limb fractures, pneumothorax, and epistaxis; the fourth injury, vertebral luxation, shared the same prevalence with epistaxis. The height of fall at 3rd to 6th storeys was positively and moderately correlated with the severity of injuries of cats with HRS ($r=0.622$; $p=0.031$; $n=12$).

Keywords: High Rise Syndrome, height of fall, injury, correlation, prevalence

1.0 INTRODUCTION

High rise syndrome (HRS) is a term that refers to traumatic injuries sustained by cats following a fall from a height of at least two storeys; it is associated HRS with the injuries triad of epistaxis, cleft palate, and pneumothorax (Robinson, 1976). In Malaysia, the height of living rooms and bedrooms in residential buildings must not be less than 2.5 metres, kitchens must not be less than 2.25 metres, and bathrooms, water-closets, latrines, porches, balconies, verandahs, garages, and the like must not be less than 2 metres (Uniform Building By-Laws 1984). As such, the minimal height of a residential building storey in Malaysia is 2.5 metres.

However, later studies reported that limb fractures are other injuries commonly associated with HRS (Papazoglou *et al*,. 2001; Vnuk *et al.*, 2004). It was suggested that it is recognised together with the injuries triad as an injuries tetralogy of HRS (Vnuk *et al.*, 2004).

There are three types of relationship between the height of fall and severity of injuries associated with HRS, which are linear relationship (Dupre *et al.*, 1995), curvilinear relationship (Flagstad *et al.*, 1998; Papazoglou *et al.* 2001), and non-definite pattern (Vnuk *et al.*, 2004).

There are limited information on the prevalence of injuries in cats with HRS presented to UVH, UPM. Hence, this study was undertaken to fill the gap of information which is required for prevention and treatment of the traumatic injuries. The prevalence of different types of injury would enable the identification of common injuries associated with the syndrome. The identification of common

injuries would aid clinicians to develop a concise differential diagnoses for traumatic injuries and to anticipate possible injuries related to HRS in order to achieve effective medical management. This information would also help raise awareness among cat owners living in high rises concerning the syndrome, in which precautionary measures are taken to prevent the cats from falling down.

The objectives of the study were:

(i) to determine the prevalence of 21 injuries associated with HRS in cats presented to the UVH, which are contusions, abrasions, wounds, lacerations, pulmonary contusions, haematuria, epistaxis, dental fractures, limb fractures, limb luxation, hard palate fractures, mandibular fractures, pelvic fractures, temporomandibular joint luxations, haemothorax, pneumothorax, abdominal wall rupture, diaphragmatic rupture, rupture of urinary bladder, vertebral fractures, and vertebral luxation,

(ii) to identify the three most common types of injuries among the types of injuries stated in the first objective, and

(iii) to determine the correlation between height of fall and severity of injuries associated with HRS in cats admitted to the UVH, UPM.

Based on the objectives above, the hypotheses of this study were:

(i) the prevalence of injuries is the same for all 21 injuries,

(ii) the highest three prevalence are the three most common injuries among the 21 injuries, and

(iii) there is no correlation between height of fall and severity of injuries.

2.0 LITERATURE REVIEW

2.1 High Rise Syndrome in cats

There are two factors that caused HRS, which are the presence of multi-storeys buildings and the behaviours of cats. Previous studies have linked summer with increased prevalence of HRS as cat owners living at multi-storey residentials opened the windows in order to reduce room temperature through improved ventilation, which predisposed the cats to HRS (Flagstad *et al.*, 1998; Papazoglou *et al.*, 2001; Vnuk *et al.*, 2004). Younger cats have higher tendency to be afflicted with HRS due to behavioural differences with older cats (Papazoglou *et al.*, 2001; Vnuk *et al.*, 2004).

2.2 Prevalence of injuries associated with High Rise Syndrome in cats

High Rise Syndrome is associated with epistaxis, hard palate fractures and pneumothorax (Robinson, 1976). As such, these injuries are called an injuries triad of HRS. However, Vnuk *et al.* (2004) and Papazoglou *et al.* (2001) reported that the incidence of limb fractures was more significant than the associated injuries stated by Robinson (1976); Vnuk *et al.* (2004) suggested that limb fractures should be included together with the injuries triad and recognised as injuries of HRS.

Epistaxis, hard palate fractures, and pneumothorax are defined, respectively, as (i) bleeding from nose, (ii) breaking of the part of the roof of the mouth supported by the palatine processes of the incisive and maxillae and the horizontal plates of the palatine bones, and (iii) entry of air into the pleural cavity in sufficient quantity to

cause collapse of the lung and consequent respiratory embarrassment (Blood *et al.*, 2007).

The following studies had reported the prevalence of the injuries (Table 1). It should be noted that Flagstad *et al.* (1998) included the prevalence of pelvic fractures together with the prevalence of limb fractures, while Siti Husna Marshad (2013) included the prevalence of limb luxations together with the prevalence of limb fractures. Even though Flagstad *et al.* (1998) and Siti Husna Marshad (2013) categorised limb fractures together with other anatomically-related categories, such a high prevalence illustrates the prominence of limb injuries in HRS. The relations are accounted by the fact that the hindlimbs are joined to the pelvis through an interface of femoral head and acetabulum, and the joints of the limbs' bones interfaced with each other to form connections.

Table 1: Prevalence of injuries associated with HRS in cats from previous studies

Studies	Epistaxis	Hard palate fractures	Pneumothorax	Limb injuries
Vnuk *et al.* (2004)	8.4%	5.0%	20.0%	46.0%[1]
Papazoglou *et al.* (2001)	2.0%	3.0%	4.0%	50.0%[1]
Flagstad *et al.* (1998)	13.5%	11%	7.1%	50.0%[2]
Siti Husna Marshad (2013)	-	-	-	73.65%[3]

[1]Only the prevalence of limb fractures was reported.
[2]The prevalence of pelvic fractures was included together with the prevalence of limb fractures.
[3]The prevalence of limb luxations was included together with the prevalence of limb fractures.

The association of pneumothorax with HRS showed the importance of thoracic radiography in affected cats. Although both Whitney and Mehlhaff (1987) and Papazoglou *et al.* (2001) recommended thoracic radiography for cats with HRS,

it was carried out in only 69% of the cats in the former study, which is in contrast with 100% in the latter study. Vnuk *et al.* (2004) explained the variation as a result of different assessment protocols, and the improvement of breathing pattern following a long time period between the falls and presentation for clinical examination, which diminished the likelihood of suspecting thoracic trauma. The latter explanation is in agreement with the observation that some animals showed minimal clinical signs of thoracic trauma (Aron & Roberts, 1993).

2.3 Relationship between height of fall and severity of injuries

The identification of relationship pattern between both factors elucidates the varied effects of height of fall upon the severity of injuries. There are three arguments held regarding the relationship between the height of fall and the severity of injuries. Dupre *et al.* (1995) reported that the relationship is linear while Flagstad *et al.* (1998) and Papazoglou *et al.* (2001) reported that the relationship is curvilinear (Figure 1), and Vnuk *et al.* (2004) reported non-definite pattern (Figure 2).

The linear relationship is defined as a reciprocal increase in the height of fall and severity of injuries. The curvilinear relationship is defined as an increase in the height of fall and severity of injuries which is consecutively reciprocal, antagonistic, and reciprocal again.

The height of fall in these studies is defined as the number of storey, in which the height of a storey is reported as approximately 3.7 metres for ground level and 2.8 metres for subsequent level (Papazoglou *et al.*, 2001) and approximately 2.7 metres for a storey (Merbl *et al.*, 2013). The severity of injuries is defined as the

number of injuries (Dupre *et al.*, 1995; Papazoglou *et al.*, 2001), and injury score (Vnuk *et al.*, 2004).

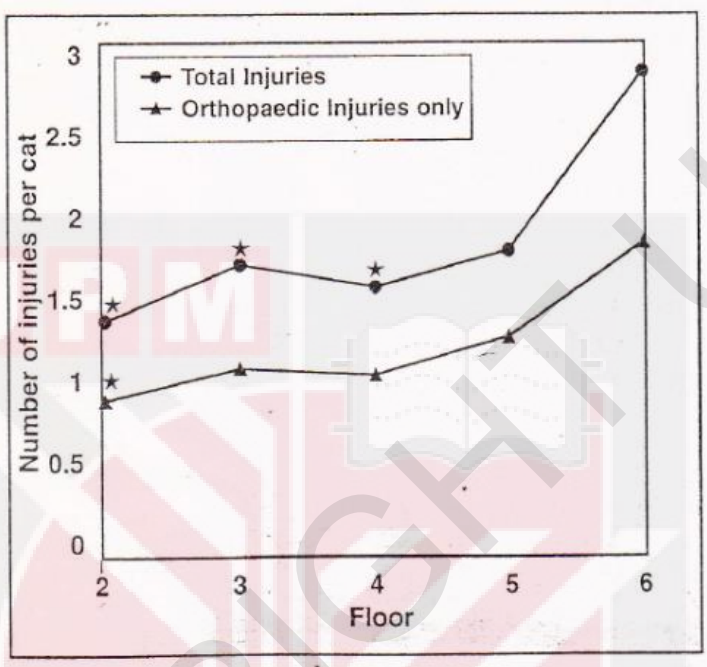

Figure 1: Curvilinear pattern of the relationship between height of fall and severity of injuries

Source: Papazoglou *et al.* (2001)

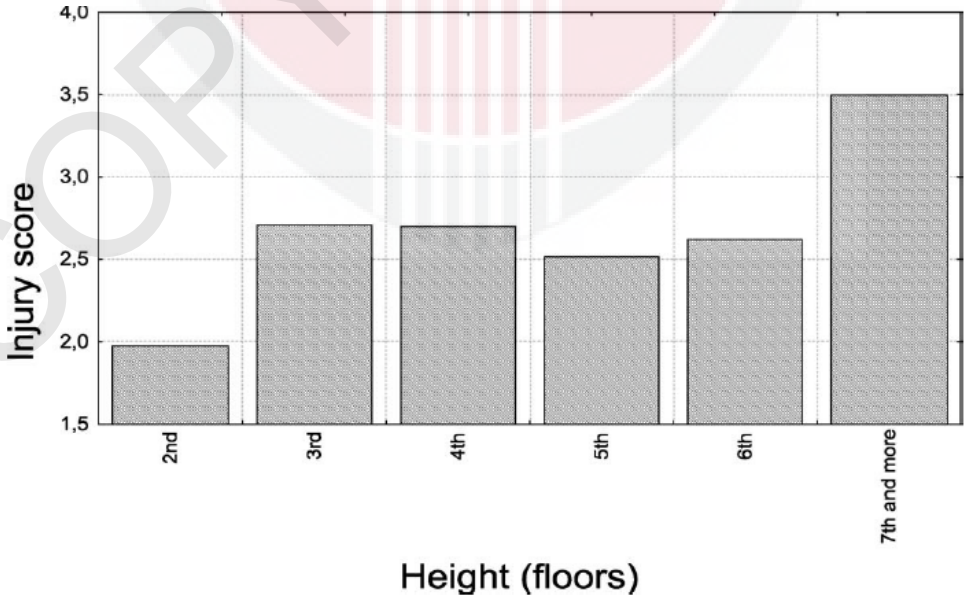

Figure 2: Non-definite pattern of the relationship between height of fall and severity of injuries

Source: Vnuk *et al.* (2004)

According to Newton's second law of motion, the force of an object (F) is equivalent to the mass of the object (m) multiplied by the acceleration of the object (a) (Crowell, 2010). Newton's third law of motion stated that the exertion of force a body upon a second body would result in simultaneous exertion of equal magnitude in opposite direction upon the first body (Crowell, 2010). The acceleration provided by Earth's gravity is approximately 9.8 m s^{-1} (Crowell, 2010). Consequently, when the object landed, there would be negative acceleration due to reduction of the object's velocity within certain amount of time. Following the exertion of the object's force upon the landing surface, an equal amount of force would be exerted in opposite direction upon the object. Thereby, as the velocity of fall increased due to acceleration by gravity, the force that would be exerted to the cats following contact with landing surface becomes greater. Therefore, the severity of injuries would be greater as the height of storey increases.

The curvilinear and non-definite patterns can be attributed to the physiology of the cats which enabled a shift of posture, leading to increased total surface area of body that came into contact with landing surface, which reduced the exerted force per unit of body surface upon contact (Whitney & Mehlhaff, 1987; Kapatkin & Matthiesen 1991; Silverstein & Hopper 2009). The posture shift also provided drag or air resistance that stopped acceleration, which maintained the terminal velocity. The cats' falling velocity plateaued at a terminal velocity of 97 km h^{-1} (Whitney & Mehlhaff, 1987; Kapatkin & Matthiesen, 1991; Silverstein & Hopper, 2009). The height of fall and landing surface (e.g. tar road) have been identified as factors that influenced the severity of injuries associated with HRS inflicted to cats (Kapatkin &

Matthiesen, 1991). The latter may provide an explanation for the non-definite pattern of graph reported by Vnuk *et al*. (2004).

3.0 MATERIALS AND METHODS

3.1 Study design and data collection

This is a retrospective study of HRS cases in cats admitted to the UVH, UPM from1 January 2002 until 31 December 2014. The reference of number of the logbooks is FPV/UVH/L001/CLB.

The criteria for case selection were diagnosis of High Rise Syndrome, fell from at least the 2nd storey, radiographic findings available, and the cats had at least one out of the 21 injuries associated with HRS in this study.

3.2 Data analysis

Data analysis was done using Statistical package of IBM SPSS Statistics Version 20 and Microsoft Excel 2010.

3.2.1 Determination of prevalence of 21 injuries associated with HRS in cats

The prevalence of the 21 injuries was determined through the findings of physical examination and diagnostic imaging. The numerator was the number of cats inflicted with one of the injuries, while the denominator was the total number of cats that fitted the selection criteria, which were 20 cats.

3.2.2 Identification of three most common injuries out of the 21 injuries

Three most common injuries associated with HRS are identified based on the three injuries with the highest prevalence, which was obtained from calculations done in 3.2.1.

3.2.3 Determination of correlation between height of fall and severity of injuries

The height of fall was indicated by the number of storeys the cats fell from. The severity of injuries was indicated as summed-up value of injury score. Based on the method adopted from Vnuk *et al.* (2004), the score assigned to the injuries were:

- contusions, abrasions, wounds, lacerations, pulmonary contusions, haematuria, epistaxis, dental fractures – score 1
- limb fractures, limb luxations, hard palate fractures, mandibular fractures, pelvic fractures, temporomandibular joint luxations, haemothorax, pneumothorax, abdominal wall rupture, diaphragmatic rupture, rupture of urinary bladder, vertebral fractures/luxations – score 2
- multiple injuries were summed up; for example, the summed-up value of injury score for contusions, lacerations, mandibular fractures, and vertebral fractures would be summed up as 1 + 1 + 2 + 2 = 6

The correlation between the height of fall and severity of injuries was determined using Pearson correlation coefficient, r. The coefficient was interpreted based on the categorisation adopted from Hinkle *et al.* (1998) (Table 2):

Table 2: Interpretation of Pearson correlation coefficient

Size of Correlation	Interpretation
0.90 to 1.00 (-0.90 to -1.00)	Very high
0.70 to 0.90 (-0.70 to -1.00)	High
0.50 to 0.70 (-0.50 to -0.70)	Moderate
0.30 to 0.50 (-0.30 to -0.50)	Low
0.00 to 0.30 (-0.30 to -0.50)	Little if any correlation

Source: Hinkle *et al.* (1998)

4.0 RESULTS

Based on the case selection criteria for this study, 20 cases were obtained. The mean age for the 17 cats was 1.1 ± 2.16 years old. The age for the other three cats was not specific, in which it was stated as adult, less than one year old, and more than one year old. The cases were 40% (8/20) female, 55% male (11/20), and 5% (1/20) of castrated male (Figure 3).

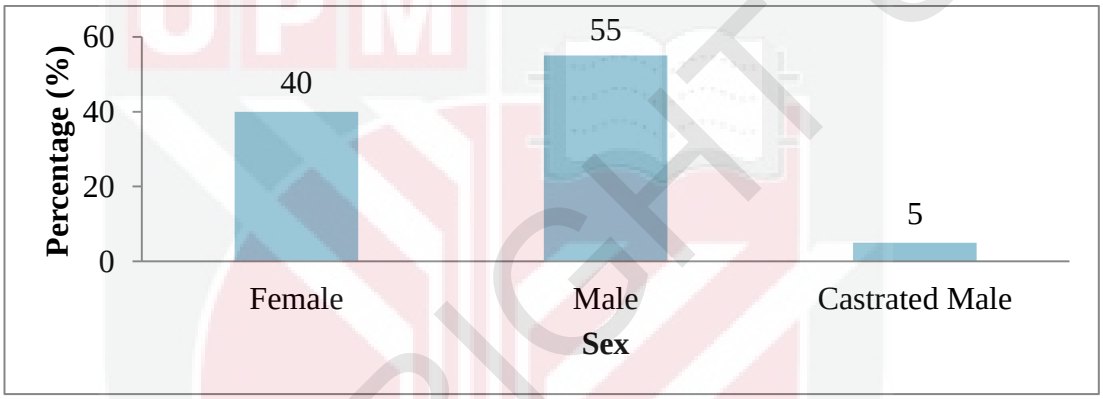

Figure 3: Frequency distribution of sex of cats with HRS, presented to the UVH, UPM (n=20)

The cases were 25% (5/20) Persian, 40% Domestic Short Hair (8/20), and 35% (7/20) of crossed Domestic Short Hair (Figure 4).

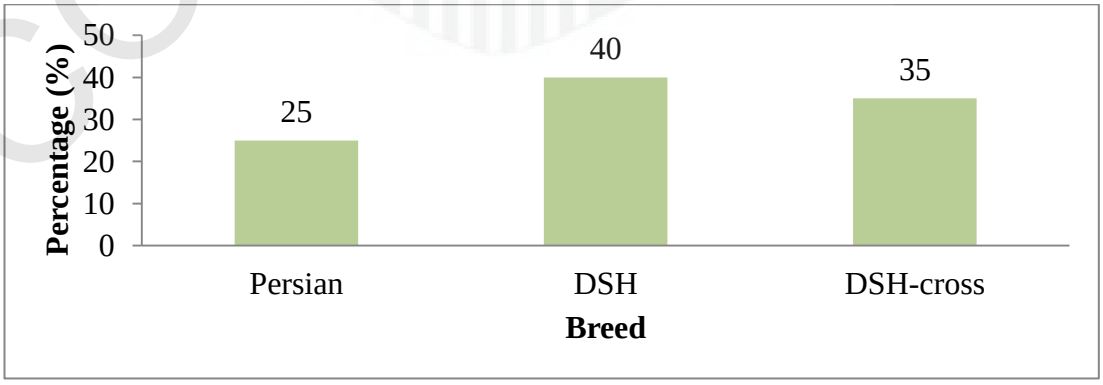

Figure 4: Frequency distribution of breed of cats with HRS, presented to the UVH, UPM (n=20)

Limb fractures has the highest prevalence of 60% (12/20), followed by pneumothorax, 30% (6/20), epistaxis and vertebral luxation, 20% (4/20), wound, haematuria, and limb luxation, 15% (3/20) each, and laceration, pulmonary contusion, dental fractures, hard palate fractures, pelvic fractures, and vertebral fractures, 5% (1/20) each (Figure 5).

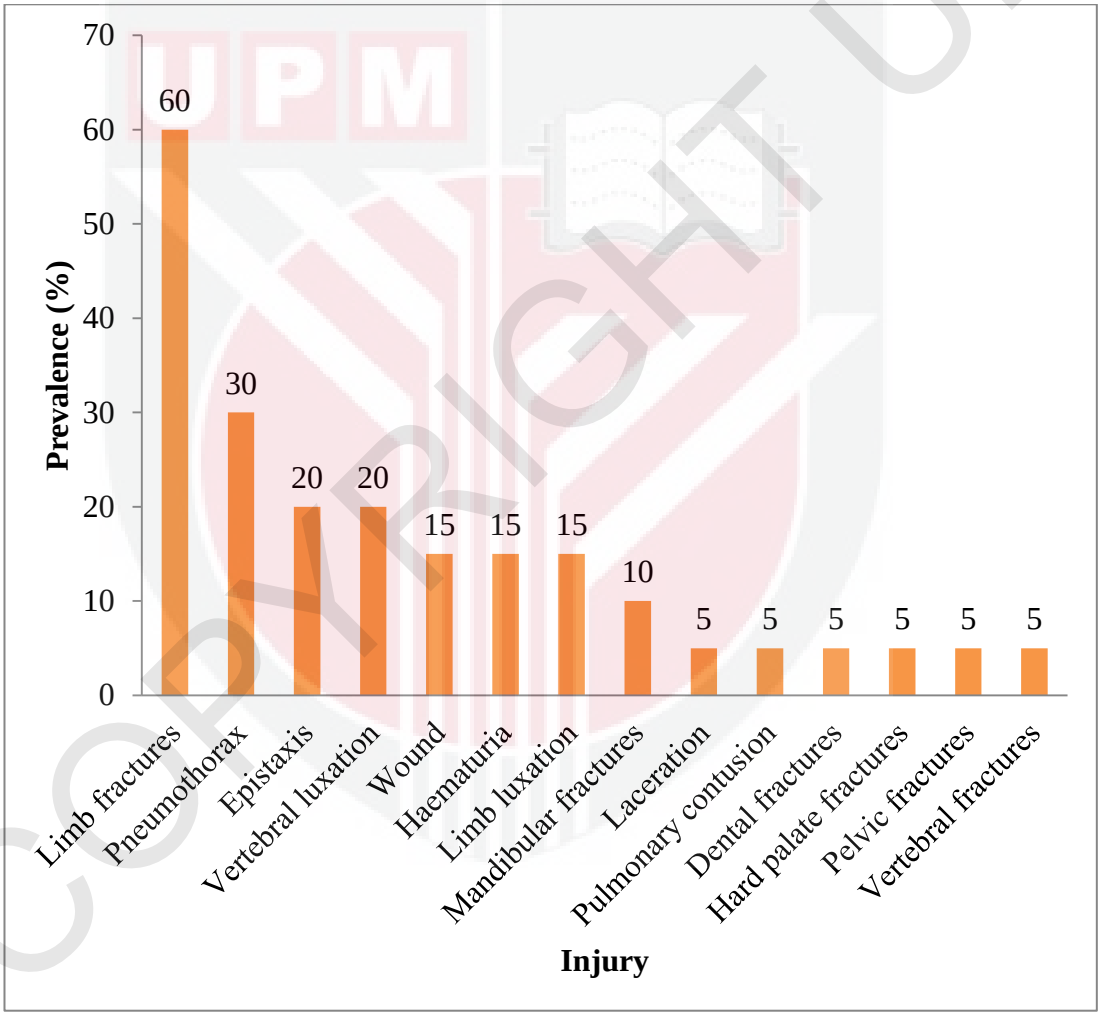

Figure 5: Prevalence of injuries associated with HRS in cats presented to the UVH, UPM (n=20)

Twenty percent (4/20) of the cases fell from each the third, fourth, and fifth storeys, 15% (3/20) fell from the eighth storey, 10% (2/20) fell from each the fifth and sixth storeys, and 5% (1/20) fell from the sixteenth storey (Figure 6).

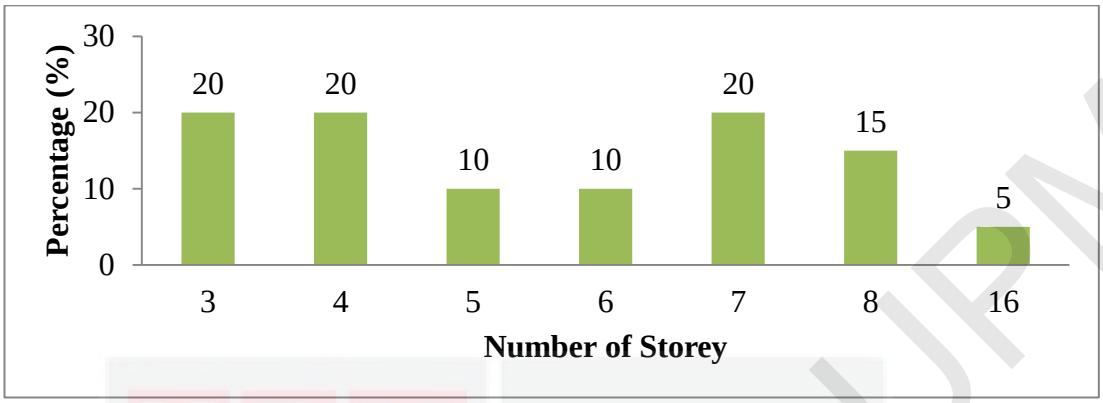

Figure 6: Frequency distribution of height of fall of cats with HRS, presented to the UVH, UPM (n=20)

Twenty percent of the 20 cases was assigned with only score 1, 35% (7/20) of them was assigned with only score 2, and 45% (9/20) of them was assigned with both scores 1 and 2 (Figure 7).

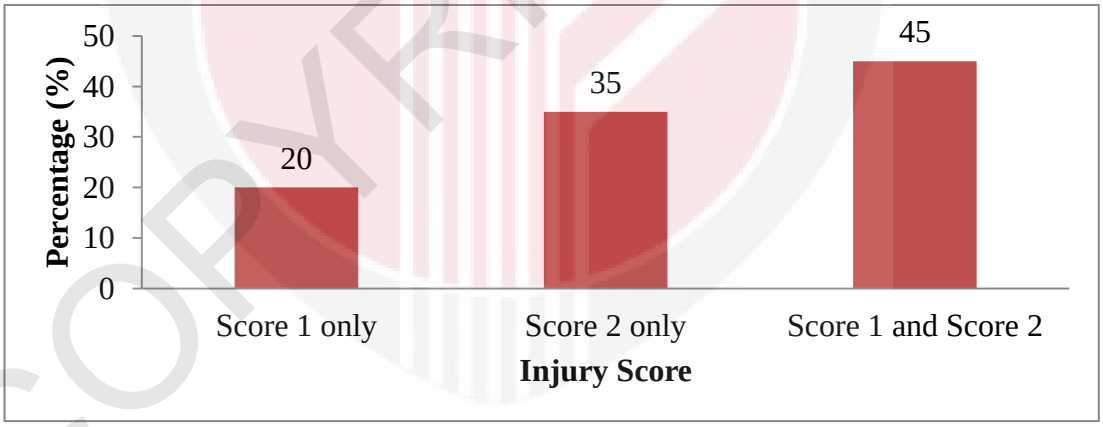

Figure 7: Frequency distribution of injury score assigned to cats with HRS, presented to the UVH, UPM (n=20)

The severity of injuries associated with HRS in this study was indicated by the summed up value of injury score. The mean severity of injuries was 3.6 $\pm$ 0.41. Twenty percent (4/20) of the cases had each summed-up value of injury score of two, four, five, 15% (3/20) had a summed-up value of injury score of one, 10%

(2/20) had each summed-up value of injury score of three and six, and 5% (1/20) had a summed-up value of injury score of seven (Figure 8).

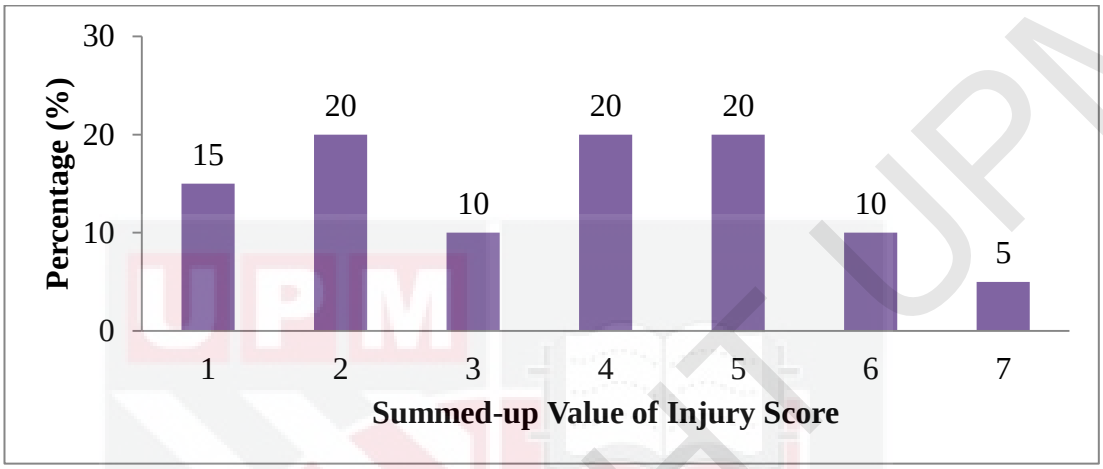

Figure 8: Frequency distribution of summed-up value of injury score of cats with HRS, presented to the UVH, UPM (n=20)

The 20 cases in this study involved cats that fell from 3rd to 16th storey of high rise residence (5.9 ± 0.67 storeys).

Table 3: Frequency and total summed-up value of injury score of cats that fell from 3rd to 16th storey (n=20)

No. of storey	Frequency	Summed-up Value of Injury Score for each case	Total Summed-up Value of Injury Score
3	0.2	2, 1, 2, 4	9
4	0.2	2, 5, 5, 6	18
5	0.1	3, 5	8
6	0.1	5, 6	11
7	0.2	1, 4, 4, 7	16
8	0.15	1, 2, 4	7
16	0.05	3	3

The sixth storey had the highest mean of summed-up value of injury score of 5.50, followed by the fourth storey (4.50), both fifth and sixth storeys (4.00), the

sixteenth storey (3.00), the eighth storey (2.33), and the third storey (2.25); there was no definite pattern (Figure 9).

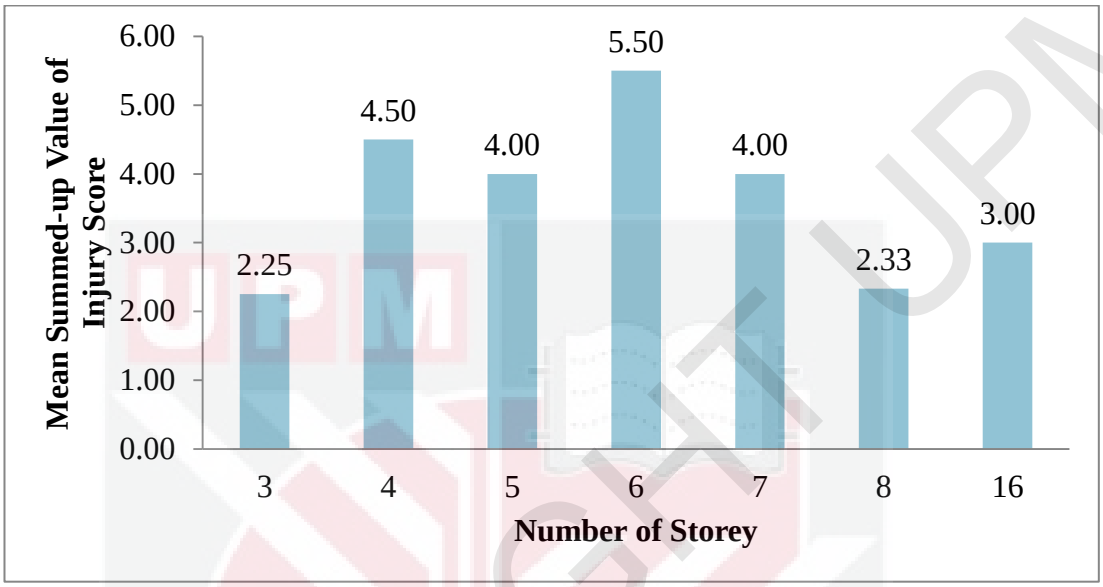

Figure 9: Mean summed-up value of injury score and number of storey (n=20)

The relationship between height of fall and severity of injuries associated with HRS in this study was significant at the range of storeys 3 - 6 (r = 0.622, p = 0.031, n = 12) (Table 4) (Figure 10).

Table 4: Correlation coefficient between range of storeys and summed-up value of injury score, significant value, and number of cases

Range of storeys	Correlation coefficient (r)	Significant value (p)	Number of cases (n)
$3^{rd} - 16^{th}$	0.037	0.878	20
$3^{rd} - 8^{th}$	0.041	0.867	19
$3^{rd} - 7^{th}$	0.334	0.207	16
$3^{rd} - 6^{th}$	0.622	0.031	12
$3^{rd} - 5^{th}$	0.493	0.148	10
$3^{rd} - 4^{th}$	0.651	0.080	8

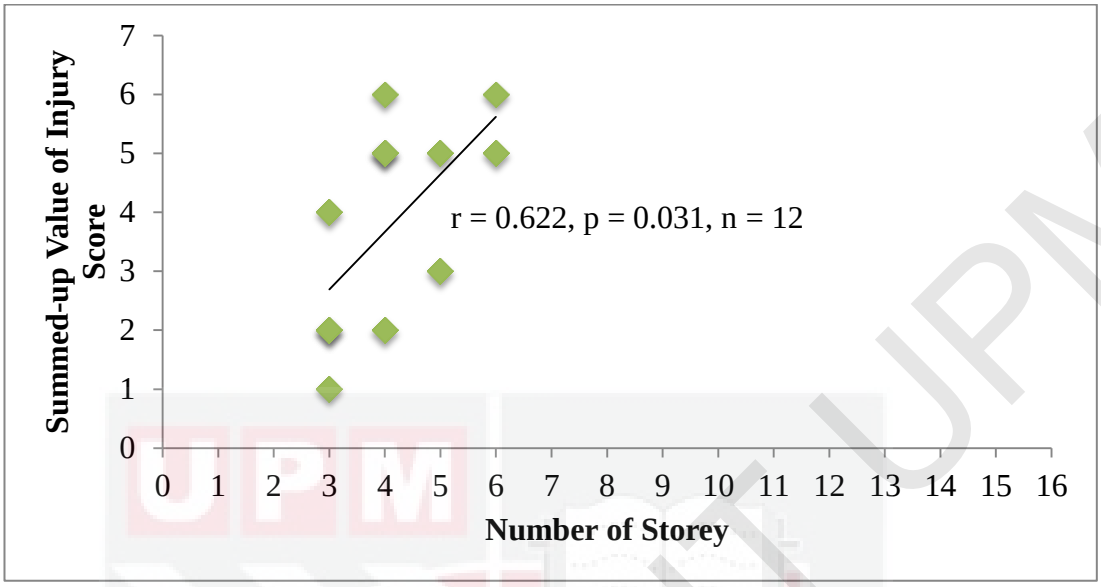

Figure 10: Correlation between range of storeys from 3 until 6 and summed-up value of injury score (n=12)

5.0 DISCUSSION

In general, cats in this study were younger than previously reported (Papazoglou *et al.*, 2001; Vnuk *et al.* 2004; Merbl *et al.* 2013). Papazoglou *et al.* (2001) and Vnuk *et al.* (2004) associated greater tendency of younger cats to be inflicted with HRS due to behavioural differences with older cats; the younger cats might have slipped from the balcony rim or windows whilst playing with objects or other animals. Sixty percent of the cats in this study were equal to or less than 1 year old.

The lower percentage of neutered cats when compared to intact cats was generally in agreement with previous studies. Hormonal influence could have affected the behaviours of some of the cats could be; it was reported that neutered cats afflicted with HRS are more common than intact cats afflicted with HRS in the United States of America due to routine neutering of cats (Vnuk *et al*., 2004).

Papazoglou *et al.* (2001) reported 68% DSH, 26% Siamese, 3% Persian, and 3% Turkish Angora. Domestic Shorthair cats had the highest percentage while Persian cats had the lowest percentage in this study. These findings are in agreement with Papazoglou *et al.* (2001). The variation could be attributed to differences in breed preferences by cat owners.

Limb fractures had the highest percentage in this study, which was consistent with Vnuk *et al.* (2004) and Papazoglou *et al.* (2001). Cats falling from heights that surpassed the fifth storey achieved the maximum velocity of 97 km h^{-1}; at this velocity, the stimulation of the vestibular system would cease (Whitney & Mehlhaff,

1987; Kapatkin & Matthiesen, 1991; Silverstein & Hopper, 2009). The absence of the stimulation resulted in the conformation of the feline body to a more horizontal position (Whitney & Mehlhaff, 1987; Kapatkin & Matthiesen 1991; Silverstein & Hopper 2009). This position could be associated with the ability to use gyroscopic turns to adjust their posture during the fall (Whitney & Mehlhaff, 1987). Furthermore, absence of vestibular stimulation could minimise the injury due to extended body and limbs, which exposed greater area of body surface to force upon contact with landing surface (Whitney & Mehlhaff, 1987). Since 67% of the cats afflicted with limb fractures in this study fell from heights that were lower than the 6th storey, limb fractures might have the highest prevalence due to partially extended limbs.

The relationship between height of fall and severity of injuries in this study had no definite pattern, which is in accordance with the studies done by Vnuk *et al.* (2004). Therefore, aside from height of fall and feline abilities during fall that was discussed previously, there was another factor that resulted in no definite pattern. Kapatkin & Matthiesen (1991) identified this factor as type of landing surface, which could altered the amount of force exerted to the cat upon contact with landing surface, and consequently, the type of injuries.

There are two limitations of this study, which compromised the strength of statistical analyses. The first factor is the limitation of the study design. In previous studies, larger number of cases were used: 207 cases (Papazoglou *et al.*, 2001), 119 cases (Vnuk *et al.*, 2004), 107 cases (Merbl *et al.*, 2013), and 172 cases (Siti Husna Marshad, 2013). The second factor is selection bias due to the needs to fulfil the

inclusion criteria, and cats that died due to HRS were not sent to UVH. Several medical cases that did not state the number of storey the cats fell from were excluded. Only cases with the diagnosis of HRS, fell from at least 2nd storey, supplemented with radiographic findings to ensure that internal injuries were accounted, and had at least one out of the 21 stated injuries were included in this study. The method of estimating the prevalence of injuries and severity of injuries resulted in the exclusion of HRS cases without radiographic results and thus underestimation of the severity of injuries.

6.0 CONCLUSION

The prevalence of 21 injuries associated with HRS in cats admitted to UVH, UPM between 1 January 2002 and 31 December 2014 are limb fractures at 60%, pneumothorax 30%, epistaxis and vertebral luxation, each at 20%, wound, haematuria, and limb luxation, each at 15%, mandibular fractures at 10%, and laceration, pulmonary contusion, dental fractures, hard palate fractures, and vertebral fractures, each at 5%. The height of fall at 3rd to 6th storeys is positively moderate and significantly correlated with the severity of injuries of cats with HRS. Findings from this study suggest that owners living in high rise buildings should be aware of the risk of severe injuries associated with HRS in their cats.

7.0 RECOMMENDATION

It is recommended that further studies on injuries associated with HRS in cats to include survival analysis, treatment and cost, and the details of fractures and luxations due to HRS which may include the type, the anatomical structure, and the location. Further studies should also have larger sample size and reduce selection bias by including feline medical cases from other hospitals and clinics.

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