

Retrospective Study of Causes and Results of Female Domestic Workers Who Fell From a Significant Height – A Single Institution Experience in Singapore

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ABSTRACT

To review the causes and results of falls of female domestic workers from significant heights of at least one storey (10-12 feet).

A retrospective study of 19 patients who fell from significant heights over a 3-year period admitted and treated by our hospital.

The average age of patients are only 23.8 years old (range 20-41), all of whom are female. Seventeen (89.5%) out of 19 patients were from Indonesia, 15 (78.9%) fell down because of housework. More than half of them suffered spine (63.2%) and lower limb (52.6%) injuries. Eleven patients (57.9%) needed surgical operation. The average hospitalization stay was 13.7 days. Two (10.5%) patients died whilst 15 (78.9%) were repatriated.

Domestic female workers in Singapore suffer high morbidity and mortality when they fall from a significant height.

INTRODUCTION

Singapore is a highly populated city-state with more than 75% of its population residing in high-rise flats. Falls from significant heights is not an uncommon happening. The purpose of this study is to review the causes and results of falls in female domestic workers and the injuries they sustained. Such a group of patients are all young adult females from neighboring countries around the region whom have come to Singapore to work as domestic helpers. The authors were interested in such a study group as their falls were mostly accidents and resulted in significant morbidity and mortality.

PATIENTS AND METHODS

A retrospective study of nineteen female domestic workers who fell from heights of at least one storey (10-12 feet)

or more. A computer database search covering all consultations at our Accident and Emergency department over a 3-year period from 1997 to 2000 was done. We identified the study cohort as foreign domestic helpers who fell from a height of 1 storey or more and admitted to our hospital for treatment. Of all the consultations, nineteen such patients were identified. A thorough case sheet review was subsequently done for them. The authors charted the demography of the patients, cause of fall, types of injuries sustained, surgical operations performed and final outcome of the patients.

The injury severity score (ISS) was also computed for all patients¹. The ISS is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to 1 of 6 body regions (Head, Face, Chest, Abdomen, Extremities (including pelvis) and External). The score ranges from 1 to 5 for minor injury to critical with uncertain survival, only the highest AIS score in each body region is used. The three most severely injured body regions have their score squared and added together to produce the ISS score. If an injury is assigned AIS of 6 (unsurvivable injury), the ISS score is automatically assigned to 75. ISS has an age dependent relationship with a lethal dose 50% (LD50) of 40 for the 15-44 age group, 29 for the 45-64 age group and 20 for the 45-65 age group.

RESULTS

All our patients were female with a mean age of 27.3 years (18-41). Of the 19 patients, 17 (89.5%) were from Indonesia, whilst the remaining 2 were from Sri Lanka and the Philippines respectively.

The reasons behind the falls were mostly due to accidents. Fifteen (78.9%) patients fell whilst doing housework, 3 (15.8%) fell whilst trying to flee from their employer and the last patient due to unknown reason. The type of housework they engaged in before falling were either cleaning of windows or hanging out of clothes for drying. None of the patients were in a state of alcoholic intoxication when brought to hospital. Five patients fell from 1st storey height (10-12 feet), six from second storey, 2 from 3rd storey, 2 from 4th storey, and the remaining 4 from 5th storey and beyond. Seventeen (89.4%) patients survived the fall and 2 (10.6%) died shortly after admission with falls from 6th and 10th storey each. (Table 1).

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Table 1. Biodata of patients who fell from height with outcome and ISS score

No	Age	Height (Storey)	Country	Reason of fall	Length of stay	Outcome	Neurology	ISS Score
1	25	2s	Indonesia	Housework	15	Repatriated	Intact	4
2	24	2s	Indonesia	Housework	14	Repatriated	Intact	9
3	25	3s	Indonesia	Housework	29	Repatriated	Intact	17
4	20	4s	Sri Lanka	Parasuicide	17	Repatriated	Intact	9
5	21	2s	Indonesia	Housework	12	Repatriated	Intact	9
6	18	6s	Indonesia	Housework	24	Not known	Intact	29
7	21	6s	Indonesia	Housework	6	Repatriated	Intact	13
8	22	2s	Indonesia	Parasuicide	1	Dead	NA	75
9	37	1s	Indonesia	Housework	32	Repatriated	Intact	25
10	22	1s	Indonesia	Housework	5	Repatriated	Intact	9
11	19	1s	Indonesia	Housework	17	Repatriated	Intact	4
12	20	1s	Indonesia	Housework	8	Repatriated	Intact	5
13	26	1s	Indonesia	Housework	5	Repatriated	Intact	4
14	18	10s	Indonesia	Unknown	1	Dead	NA	31
15	22	1s	Indonesia	Housework	3	Not known	Intact	2
16	41	2s	Indonesia	Housework	7	Repatriated	Intact	17
17	28	2s	Phillipines	Parasuicide	5	Repatriated	Intact	5
18	20	3s	Indonesia	Housework	24	Repatriated	Paraplegic	29
19	23	5s	Indonesia	Housework	35	Repatriated	Intact	29

All patients had significant injuries (Table 2). Musculoskeletal injuries predominated, occurring in all 19 of our patients. Amongst the skeletal injuries, spinal injuries were most common accounting for 63.2%, followed by lower extremity (52.6%), pelvis (36.8%) and upper extremity (21.1%). Only 15.8% (3/19) of the patients

suffered head injuries; these were stable and did not require surgical intervention. Two retroperitoneal injuries were detected, with laceration of kidneys and massive bleeding. These 2 patients perished despite resuscitative measures and operative intervention. We did not have any patients with intra-abdominal injuries.

Table 2. Incidence of various injuries in 19 fall victims

Site	No of patients with specific injuries	Percent of patients (n = 19)
Head injuries	3	15.8
Craniofacial fractures	1	5.3
Spinal injuries	12	63.2
Cervical spine	1	5.3
Thoracic spine	3	15.8
Lumbar spine	8	42.1
Coccyx	1	5.3
Pelvis fracture	7	36.8
Upper Limb	4	21.1
Lower Limb	10	52.6
Retroperitoneal injuries	2	10.5
Abdominal and Chest	0	0

Spinal injuries

Spinal trauma was the most common skeletal injury in our cohort. In 11 out of 12 patients the injury was confined from T12 to L5 area. 58.3% (7/12) suffered compression fractures of the thoracolumbar spine, two patients sustained burst fractures of the lumbar spine that required spinal stabilization and instrumentation, 2 patients suffered lumbar transverse process fractures and 1 patient had contusion of the coccyx (Figs 1a and b). Only 1 patient suffered permanent neurological deficit from complete spinal cord injury. Associated pelvis or lower limb fractures were recorded in 9 out of the 12 patients.

Pelvis and Lower Extremity fractures

Two of the 7 patients with pelvic injuries were minor with pubic rami fractures. The remaining five had disruptions of the pelvic ring and acetabulum from shearing forces that were transmitted vertically through the skeletal structure (Figs 2a, b and 3a, b).

Of the lower limb injuries, 60% (6/10) of patients suffered fractures of the calcaneum, and the remaining 30% (3/10) fracture of the tibia bone and the last 10% (1/10) had metatarsal head fracture.

Upper Extremity fractures

Four patients (21.1%) had upper extremity fractures. Out of these, three had fractures of the humerus and one of the distal radius.

Management and outcome

The average hospitalization stay for all patients was 13.7 (1-32) days. After initial resuscitative measures, 11 (57.9%) patients needed surgical treatment. This is summarized in Table 3. None of the patients develop ARDS (acute respiratory distress syndrome) in our cohort. None was admitted to the intensive care unit too.

The patients were grouped according to their ISS scores into 3 groups. Eleven patients had ISS score of 1-14, 7 had score of 16-66 and one with a score of 75. Two patients died shortly after admission secondary to intra-abdominal injuries. They had ISS score of 34 and 75 respectively.

Of the 17 survivals, 15 were repatriated back to their home country after discharge from hospital and 2 patients whereabouts unknown. One patient was paraplegic from a cord transection at T12 level. The rest had functional lower limbs.

DISCUSSION

Many authors have pointed out that survival and the severity of injuries after free falls depended on the height of the fall^{2,3}. Lau et al⁴ constructed mathematical model studies which showed that the height of fall was significantly associated with ISS, age and extent of injury. We found that the height of fall corresponded to the severity of injury (higher ISS score). Our study showed that there was significant increase in severity of injury with falls from fifth storey and beyond, assuming a height of 10-12 feet per storey.

Several factors dictate the severity of injury in free falls trauma. The primary determinant is velocity of impact,

which can be summarized by the formula $V=2gS$, where V is velocity, g is the force of gravity (9.8m/s), and S is distance⁵. Other factors include the area over which the force is distributed (orientation of the body), the type of surface on which the victim lands, and the age and physical condition of the victim. A horizontal impact results in less severe injury as the force is spread over a greater area. Impacting on soft surface (e.g. snow) also lessen the injury. Young age and a healthy physical condition also tend to increase survival.

This cohort of patients involved mostly falls due to accidents incurred by healthy young victims. Death occurred primarily as a result of massive retroperitoneal bleeding and was primarily dependant upon the distance fallen. Most of our patients landed on concrete ground or pavement. Survival and lower morbidity therefore appeared to be a function of healthy young adults falling relatively short distance.

The patterns of injuries in this study group were similar to other studies^{2,3,6} with spinal column injuries as the most common. Also these injuries were predominantly in the thoracolumbar junction region. Therefore, an important point in initial management is the thorough assessment clinically and radiologically of the spine in all patients.

The second commonest injury site was in the lower limbs. There were high association of these with spinal column injuries. This suggested that most of these patients landed feet first on the ground resulting in fractures of the calcaneum and the forces were transmitted on to the spine from the lower limbs.

The incidence of head injuries was relatively low. This may be due to the fact that most of the falls were due to accidents and patients were under no alcohol or drug influence. Blunt abdominal trauma was uncommon but was the cause of death in both our patients, who had kidney lacerations.

Table 3. Injuries sustained and the operations performed

No	Injuries sustained	Surgery
1	Compression #L1	N
2	Compression #L2, C6/7 cervical disc protrusion	N
3	Chance #L1, right sup, inf pubic rami #, right distal radius #	Y, posterior stabilisation with pedicle screw and fusion
4	Tibia open #, mandible #	Y, wound debride tibia, plaster casting, ORIF mandible
5	Compression #T12, 4 th metatarsal head #	Y, T&S little toe
6	(R) humerus neck, distal condylar #, (R) acetabulum #, skull base #	Y, Steinman pin traction, ORIF humerus
7	Compression #L1,L2, (R) distal tibia #	Y, ORIF tibia
8	Pelvic #, (R) humerus #, elbow #, lower kidney laceration	Y, Laprotomy
9	(R) inferior pubic rami #, acetabulum #, double column	Y, ORIF (R) acetabulum #
10	Compression #T12, spondylolysis L4, calcaneum # undisplaced	Y, total body cast
11	(L) tibial plateau #	Y, ORIF tibial plateau #
12	Head concussion, (R) humerus #	N
13	(L) calcaneum #	N
14	Kidney laceration, pelvis # diastasis SI jt, lumbar transverse process #	N, died despite resuscitation
15	Stable hi, coccyx contusion	N
16	Compression #T12, (L) calcaneum # (L) inferior pubic rami #	N
17	Compression #L5, (L) calcaneum #	N
18	Burst L1#, bilateral calcaenum #	Y, posterior stabilization with pedicle screw and fusion
19	Pelvic #, si jt dislocation, lumbar transverse process #, calcaneum #	Y, ORIF pelvis

This study showed that more could be done to educate and familiarize our foreign domestic workers to their environment. Most of them come from a rural environment and the hazards of domestic chores in a high-rise living environment are not fully appreciated. The authors

recommend that foreign domestic workers working in high-rise environment should be given course of instruction. This could help to reduce the incidence of such unfortunate accidents.



Fig. 1a. 20 years old Indonesian maid who fell from 2nd story sustaining burst L1 fracture and bilateral calcaneum.

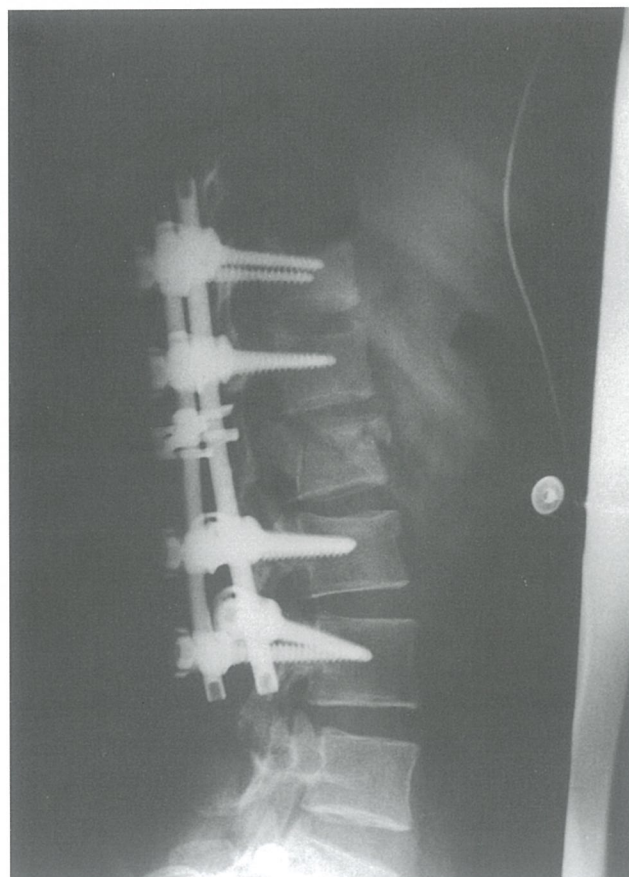


Fig. 1b. Posterior instrumentation done for stabilization.



Fig. 2a. 37 years old Indonesian maid who fell from 2nd story sustaining bicolumnar right acetabulum fracture



Fig. 2b. Fixation and reduction of the anterior, posterior acetabular fractures.

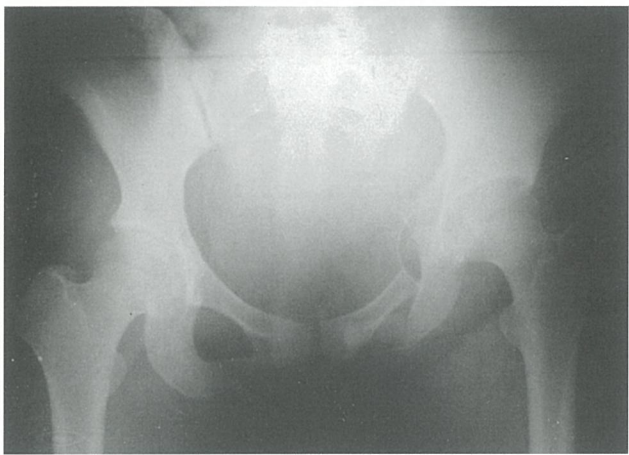


Fig. 3a. 23 years old Indonesian maid who fell from 5th story sustaining pelvic vertical shear injury with sacroiliac joint disruption.

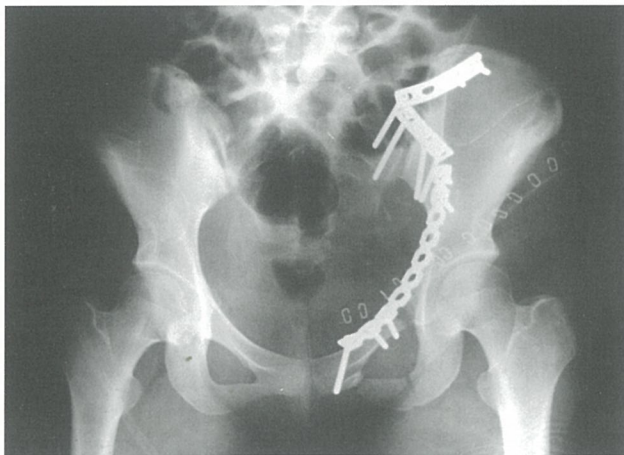


Fig. 3b. Reduction and fixation of iliac to sacrum bone.

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