Recent changes in the pattern of hand injuries in Hong Kong: a regional hospital survey

LK Hung, KY Choi, K Yip, J Chan, PC Leung

Adult inpatients with injuries to the hand admitted to the Department of Orthopaedics and Traumatology of the Prince of Wales Hospital, Hong Kong, from June 1992 to May 1993 were surveyed (n=533). The causes of injury, mechanisms involved, and the nature of injuries were recorded. The injuries were further graded according to four different scales. It was found that 65% of the injuries were sustained at work, 15% in domestic environments, 7.6% during sports or recreational activities, and 6.5% in traffic accidents. Injuries caused by heavy machinery amounted to 26.7% and the electric saw was the second most common cause of injury accounting for 9.4% of injuries. Crush injuries occurred in 37.8%. The incidence of hand injury is estimated to be 600 per 100 000 population annually. The pattern of hand injuries bears some similarities and differences to published series. A comparison with data obtained in Hong Kong in the 1970s shows that major changes have occurred. We need continual surveillance of hand injury patterns.

HKMJ 1997;3: 141-8

Key words: Hand injuries; Injury severity score; Fractures, hand; Occupational safety; Treatment outcome

Introduction

Despite advances in science and technology, many manufacturing and construction activities are carried out manually. Injuries to the hand, especially at work, are thus common. In the 1970s, Leung reported that the incidence of occupational hand injuries (OHI) in Hong Kong amounted to 70% of all types of hand injuries, and 50% of all occupational injuries.[1-2] During the past two decades there seems to have been a decrease in the incidence of hand injuries. An editorial in the *Lancet* in 1986 stated that "...there is increasing evidence that less than a third of all hand injuries now occur at work."[3] Some people even felt it was no longer worth the effort to survey or monitor the incidence of hand injuries. In a way, that was a sign of progress—better industrial safety, less manual labour, and more high-technology industries. Towards the late 1980s and the early 1990s, however, we saw again a progressive increase in the incidence of hand injuries in our hospital, and many of these were still work-related. We believe it is necessary to update our information on the incidence and pattern of hand injuries to understand the underlying nature and reasons for the change. The findings of our survey will be important for injury prevention, as well as the planning of services for these patients.

Materials and methods

A survey was conducted prospectively from June 1992 to May 1993. All adult patients with hand injuries admitted to the Department of Orthopaedics and Traumatology, Prince of Wales Hospital, were surveyed prospectively using a standard proforma. The individual's occupation, mechanism of injury, and the cause of the hand injury were recorded. The severity of injury

Accident and Emergency Department, Prince of Wales Hospital, Shatin, Hong Kong
LK Hung, MCh, FHKAM (Orthopaedic Surgery)
KY Choi, MB, ChB, FRCS
K Yip, MB, BCh, FHKAM (Orthopaedic Surgery)
PC Leung, MS, DSc

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Shatin, Hong Kong
J Chan, MB, BS, FHKAM (Surgery)

Correspondence to: Dr LK Hung

was rated and scored according to three scoring schemes: the digital score index (Strickland),[4] the number of and nature of fractures—in particular open fractures (modified Gustilo's classification),[5] and the systemic effects of the injury (the Mangled Extremity Severity Score, MESS).[6] A projected outcome score was also rated according to the expediency and completeness of recovery of hand functions after the injury. Statistics of attendance at the Accident and Emergency (A&E) Department of the Prince of Wales Hospital were reviewed and the number of attendances due to injuries of the hand over a one-year period were obtained.

Table 1. Comparison of sex distribution and causes of injury between patients attending the Accident and Emergency Department, Prince of Wales Hospital, and those admitted

	A&E* (n=6137) No. (%)	Admitted (n=533) No. (%)
Men	84 (30)	506 (95)
Women	4296 (70)	27 (5)
Occupational injuries	2479 (40.4)	347 (65)
Domestic injuries	2477 (40.4)	80 (15)
Traffic accidents	178 (2.9)	35 (6.5)
Sports/recreational injuries	411 (6.7)	41 (7.6)
Assaults	141 (2.3)	
Animal/insect bites	301 (4.9)	32 (5.9)
Others	141 (2.3)	

*A&E Accident and Emergency Department figures based on A&E records from January through December 1994

Results

Since reliable data from the A&E Department could only be obtained after computerisation began in January 1994, the data in that year were used as a reference for comparison. From January through December 1994, there were 190 338 A&E attendances, of which 28 584 were caused by injury (15%); of these 6137 were hand injury cases (21.5% or 3.2% of all A&E attendances). We assumed that the same figures also applied to the 12 months of our study period, which means that approximately 6000 hand injury cases would have attended the A&E Department. About 10% of these were admitted to the Department of Orthopaedics and Traumatology and the notes of 533 patients were studied (85% of all admitted cases). In addition, there were 45 children and 36 patients with burns of the hand admitted over the same period; these are not reviewed in this survey.

The survey results for these 533 adult patients are summarised in Table 1. There were 505 men (95%) and 28 women. This is very different from the female predominance (70%) of A&E attendances. The mean age was 36 years (range, 13 to 82 years). Although not all patients were working (74%), 65% of the injuries were sustained at work. Injuries that occurred at home accounted for 15%, injuries during sports activities or at leisure amounted to 7.6%, and traffic accidents, 6.5%. The corresponding distribution for those attending the A&E are also shown in Table 1.

Eighty per cent of patients were employees, 6.7% were employers or self-employed, and 6% were students. Injury related to the use of heavy machinery occurred in 26.7%, 12% involved a knife, 9.4% were due to electric saw, 10% as a result of a fall, and 5% were caused by doors. Despite a right hand dominance in 96% of patients, both hands were involved equally (R:L = 49% vs 49%), and 10 patients had bilateral injuries.

With regard to the nature of the injury, 42.7% were simple lacerations, 16.9% were rugged lacerations, 37.8% were crush injuries, and 1.4% were degloving injuries.

The average hospitalisation time was three days, although about one half stayed for one day only.

Fracture score

Nearly 50% of all patients had at least one fracture (Table 2) and 32% had an open fracture or multiple fractures in one hand. Twelve and a half per cent had a score of 4 or above, i.e. the fracture was at least equivalent to a Gustilo open type III A fracture, or there were multiple fractures in the same hand.

Mangled extremity severity score

As can be seen from Table 3, 52.7% had a MESS score of 2 or above, and 10.6% had a score of 4 or above, which means either a very severe injury in a young person or a medium-energy injury in a geriatric patient. Only 2.5% had a score of 7 or above, the dividing line for unsalvageable limbs.[6]

Table 2. Fracture scores, modified from Gustilo's classification of open fractures[5]

(a) Fracture scores

Type	Description	Score
No fracture	-	0
Closed fracture	-	1
Open fracture	a fracture with an open wound	
Type I	small open wound from inside	2
Type II	larger wound from outside	3
Type III A	larger wound with loss of skin	4
Type III B	extensive soft issue defect that requires special skin coverage	5
Type III C	ischaemia present or amputation needed	6

(b) Results

Type	No. (%)
No fracture	271 (51)
Closed fracture (Score 1)	92 (17)
Subtotal	68.0%
Open fractures/multiple	
Score 2	68 (12.8)
3	37 (7)
4	36 (7)
5 or above	29 (5.5)
Subtotal	32.3%
Total	**533**

Digital score (Strickland)

The scoring is shown in Table 4. Forty per cent of patients had a score at or above 4. A score of 10 indicates an unsalvageable finger that would need amputation; 7.3% of patients had a score at or above 10.

Projected outcome

To provide a profile of the ease of recovery of patients, an empirical scale with four scores was designed (Table 5). Each score represents a different severity of injury and the complexity of rehabilitation required. A score was assigned to each patient on discharge from hospital. While the majority were expected to make a smooth recovery, 16.4% were not, requiring prolonged rehabilitation and time away from work.

Discussion

The patients surveyed in this study represented about 85% of all patients admitted with hand injuries during the same period, or 8.7% of A&E attendances with hand injuries. The total number of A&E attendances for hand injuries during the study period was estimated to be approximately 6000. Given that the population of New Territories East and the North East region at the time was around one million, the incidence of hand injuries is 600 per 100 000 population annually—an alarmingly high figure. This also does not include minor injuries that could have been managed and discharged at the Tai Po or Sheung Shui Clinics, or attendances at private practices. Otherwise, the figure may have been higher. Different studies have given various incidences of hand injuries ranging from 3.7 per 100 000 population per year in Denmark[7] to 1981 per 100 000 population per year in Russia[8] (Table 6). Obviously, these different studies surveyed slightly different target populations. The lowest incidence of 3.7 per 100 000 population was reported from a large scale comprehensive survey in Denmark that assessed almost 13% of the population.[7] The figure quoted from Derby, UK, was 475 hand injuries per 100 000 population annually,[9] which is similar to that of the present study. The reason for such large differences may reflect different survey methodologies or different socioeconomic factors. It is more likely that socioeconomic factors play a major role in the incidence of hand injuries, as was suggested in the pioneering work of Rank et al in the 1950s[10] and the work of Leung in the 1970s.

The pattern of hand injuries

Twenty per cent of all injured people who attended the A&E Department had hand injuires; the 3.2% with hand injuries compared with an overall 15% of all kinds of injuries, similar to the 26% and 28% quoted in re-

Table 3. Mangled Extremity Severity Score[6]

(a) The scores

Scores	(A) Extent of skeletal/ soft tissue injury	(B) Shock	(C) Ischaemia to limb/ digit (less than 6 hours)	(D) Age (y)
0	closed	no, BP*>90	no ischaemia	<30
1	low energy	resuscitated	perfused, pulseless	30-50
2	medium energy (open fracture)	persistent low BP	decrease in perfusion	>50
3	high energy (gunshot, crush)	-	ischaemic	-
4	very high energy	-	-	-

*BP blood pressure

(b) Results

Score	No. (%)
0	76 (14.3)
1	177 (33.2)
2	119 (22.3)
3	105 (19.7)
4	19 (3.6)
5	8 (1.5)
6	16 (3)
7 and above	13 (2.5)
Total	**533**

ports from Russia[8] and Cleveland, UK,[11] respectively. We also found a very high rate of OHIs—40% of A&E attendees and 65% of admitted patients. These figures are much higher than the figures reported from Denmark (26%) (Table 7),[7] as well as the 30% incidence reported from the United States (Chicago), which looked specifically at OHI.[12] At the same time, the figures are different from the earlier findings of Leung (Table 8). At that time, 70% of the surveyed cases in the A&E Department had hand injuries, compared with only 40% today. It was also likely that most of the admitted cases then were OHIs, compared with the 65% in our present survey. Among the admitted cases, heavy machinery was the cause of injury in 25% and 37.8% of injuries were crush-related. These figures are different from the findings of Leung, which found 65% and 74%, respectively (Table 8). This probably reflects a change in the practices of industry, which are discussed further below. Most of the OHIs we surveyed were sporadic and isolated episodes with no definable pattern but one aetiological factor stood out as an identifiable factor—the electric saw, which was responsible for 9.4% of injuries, and was second only to the knife. This warrants further investigation.

Hand injuries occurring at home, accounted for 40% of all A&E attendances and 15% of admitted cases, and those occurring during sporting or recreational activities were 6.7 % and 7.6%, respectively. The large-scale Danish survey also found a 34% incidence of domestic injuries and 35% of injuries sustained at leisure.[7] The local incidence of injuries sustained at leisure or while playing sport may continue to rise with time. It is also quite likely that some of the domestic injuries included injuries sustained by children in playgrounds when they were not engaged in any particular game or sport. These observations suggest to us that there should be more emphasis on promoting safety awareness and the prevention of accidents at home and during leisure time. The predominance of women (70%) among the A&E attendees with hand injuries, coupled with the high incidence of domestic injuries (40%) suggests that women are an at-risk group for domestic injuries. At the same time, the predominance of men in the admitted group is in agreement with the fact that most machine and tool operators in Hong Kong are men, although male predominance for OHIs is common in studies worldwide.[11,13]

Grading of injuries

As mentioned, a large proportion of cases admitted to hospital had serious and disabling injuries. The use of a scoring system to describe hand injuries is not

Table 4. Strickland Digital Score[4]

(a) Digital score (Strickland)

Skin, subcutaneous tissue		Tendon (motion)	
No involvement	0	No involvement	0
Simple laceration	1	One tendon, reparable	1
Compound laceration or crush	2	Two tendons, either one reparable	2
Extensive	3	Two tendons, both irreparable	3
Bone (stability)		Nerve (sensation)	
No involvement	0	No involvement	0
Simple fracture, undisplaced	1	One nerve, reparable	1
Displaced fracture, no comminution	2	Both nerves, reparable	2
Displaced with comminution	3	One or both nerves irreparable	3
Joint (motion)		Vessel (circulation)	
No involvement	0	No involvement	0
Mild crush or adjacent undisplaced fracture	1	Single artery injury	1
Severe crush or articular fracture	2	Both arteries, one or both reparable	2
Both arteries irreparable	3	Both arteries irreparable	3

(b) Results

Digital score	**No. (%)**
1	25 (4.7)
2	153 (28.7)
3	142 (26.6)
4	53 (10.0)
5	65 (12.0)
6	31 (5.8)
7	11 (2.0)
8	5 (0.9)
9	9 (1.7)
10 or above	39 (7.3)
Total	**533**

commonly practised. The use of the Glasgow Coma Score, Injury Severity Score, or MESS to describe a serious injury or a severely injured limb has demonstrated their usefulness, both in rapid communication, in determining triage of cases, and prognostication. The use of a scoring system should be equally useful in the management of hand injuries. In this survey, we applied four different scores. Applying the Strickland digital score (Table 4), 40% of the cases had a score at or above 4, and a significant 7.3% had a score of 10 or above, which may mean amputation. The Strickland score seems to be the most comprehensive in addressing the types of injury to a digit. However, modification is needed when multiple digits are involved. We have simply added up the total for each digit. This provides an overall impression of the degree of injury to the hand, which is still true, but exaggerates the situation of multiple minor injuries when three or four digits are involved. Whether a certain number according to the Strickland score (e.g. 10 as was initially suggested) indicates an amputation of the digit as the choice of treatment is open to debate.

The fracture score gave us another perspective (Table 2). Nearly 50% had one or more fractures in their hands and two thirds of these fractures were either open (compound) or multiple; 12.5% had a fracture score of 4 or above. The fracture score only gives an indirect rating of the magnitude of trauma to the hand. Unfortunately, it does not include nerve and tendon injuries, which are very important aspects of hand injuries.

Table 5. Projected outcome

(a) The schema of scores

Score	Description
1	Routine recovery. Able to return to work in 3 months. No secondary procedure required.
2	Requires prolonged intensive therapy for 3-6 months, possibly requires secondary procedures. In general, can return to original job.
3	Requires 6-12 months of rehabilitation, may lose part of the hand (amputation), and a change of job required.
4	Severe mutilation, requires longer than 1 year of rehabilitation and several staged procedures. Daily activities significantly affected.

(b) Results

Outcome	No. (%)
1	446 (83.7)
2	76 (14.3)
3	7 (1.3)
4	4 (0.8)
Total	**533**

The MESS is probably not a very sensitive index when only the hand is assessed (Table 3). In our cases, 10.6% had a score at or above 4, indicating either a serious injury or one in the older age group. Only 2.5% had a score at or above 7, the dividing line for an unsalvageable limb or digit,[6] which was likely to be an under-estimation. However, the MESS may serve the function of screening out injuries in the older age group.

As was reflected in the projected outcome scoring, 16.4% of patients were felt unlikely to make a smooth recovery within three months, but this was only a subjective rating. It is necessary to examine the final outcomes of the patients after at least two years before the predictive values of these scoring systems can be fully evaluated. This will be part of a future study.

Table 6. Comparison of reported incidences of hand injuries

Country	Incidence (/100 000 population annually)
Vitebak, Russia (1990)[8]	1981 (cities) 737 (rural areas)
Derby, UK (1991)[9]	475
Denmark (1993)[7]	3.7
Denmark (1994)[13]	1710 (occupational)
Current survey (1992/93)	600

Changes in patterns of hand injuries

The surveys conducted by Leung in the 1970s[1,2] showed that the incidence of hand injuries at that time was high. There was a decline in the incidence of hand injuries in the 1980s. One can attribute this change to improved injury prevention.[3] Another factor that could be important is the relocation of many manufacturing industries to China in the late 1980s and early 1990s. This removed from Hong Kong many of the automatic or semi-automatic machines that were the main cause of OHIs.

The Prince of Wales Hospital was opened in 1984 and we were caught in the middle of these changes. Entering the 1990s, we have experienced a gradual increase in the incidence of hand injuries. The present survey substantiates this impression. There are approximately 600 hand injuries per 100 000 population annually, and the percentage of OHIs still stands at a high rate (40% of A&E attendances and 65% of those admitted).

Over the next decade, it is generally believed that Hong Kong will receive more immigrant workers from China (a risk factor identified in previous surveys),[1,2] so we may expect to see an increase in the incidence of OHIs. At the same time, there is a relatively high incidence of domestic injuries and injuries that occur at leisure, which suggests that when people take time out and become involved in more vigorous recreational and sporting activities, associated injuries are likely to become more frequent. All these observations remind us that we should put more effort into identifying the inherent risks of activities,[14,15] educating people on how to avoid them, and never to be complacent about hand injuries.

Table 7. Comparison of causes of hand injuries found in the current survey with a 1993 Danish study[7]

	Angermann & Lohmann Denmark (%) (n=15 000 approx)	Current survey - A&E attendance (%) (n=6137)	Current survey - admitted cases (%) (n=533)
Proportion of hand injuries	28.6%	21.5%	-
Incidence of hand injuries	3.7/100 000	600/100 000	-
Domestic hand injuries	34%	40.4%	15.0%
Injuries at leisure	35%	6.7%	7.6%
Occupation hand injuries	26%	40.4%	65.0%
Road traffic accident	5%	2.9%	6.5%
Admission rate	2%	10%	-
Specialist referral	13%	na*	-

*na not available

Acknowledgement

The authors wish to acknowledge the efforts of the following colleagues in assisting with the compilation of patient data: Drs OB Lee, CC Kong, KW Pang, YC Wun, CK Ko, TK Lung; the Dean of the Faculty of Medicine, CUHK, who during the time of the study was Prof AKC Li, the Chairman of the Department of Orthopaedics & Traumatology, Prof KM Chan, and the Hospital Chief Executive of the Prince of Wales Hospital, Dr A Reid, for supporting this project.

References

1. Leung PC, Ng TK. A preliminary look into the causative factors of occupational hand injuries in Hong Kong. Bull HK Med Assoc 1978;30:1-13.
2. Leung PC, Ng TK. Occupational hand injuries - the pattern and the causes. J West Pac Orthop Assoc 1979;53:491-510.
3. Causes and consequences of hand injury [editorial]. Lancet 1986;2:1076-7.
4. Strickland JW. A rationale for digital salvage. In: Strickland JW, Steichen JB, editors. Difficult problems in hand surgery. St. Louis: CV Mosby, 1982:243-52.
5. Gustilo RB, Mendoza RM, William DN. Problems in the management of type III (severe) open fractures: a new classificcation of type III open fractures. J Trauma 1984;24:742-6.
6. Helfet DL, Howey T, Sanders R, Johansen K. Limb salvage versus amputation. Preliminary results of the mangled extremity severity score. Clin Orthop Relat Res 1990;256:80-6.
7. Angermann P, Lohmann M. Injuries to the hand and wrist. A study of 50,272 injuries. J Hand Surg (Br) 1993;18(5):642-4.
8. Deikalo VP. Clinical and statistical aspects of injuries and diseases of the hand. Ortop Travmatol Protez 1990;12:21-5.

Table 8. Comparison of the current survey with a previous study by Leung (1981, unpublished observations)

	Current study (1992/93) (n=533) No. (%)	Leung (1981) (n=2218) No. (%)
% OHI* of total hand injuries	2479/6137 (40.4) [A&E] 347/533 (65.0) [Admitted]	1553 (70.0) [A&E]
Heavy machinery involved	142 (26.7)	1442 (65.0)
Crush injury sustained	201 (37.8)	1641 (74.0)

* OHI occupational hand injury

9. Burke FD, Dias JJ, Lunn PG, Bradley M. Providing care for hand disorders: trauma and elective. The Derby Hand Unit experience (1989-1990). J Hand Surg (Br) 1991;16(1):13-8.
10. Rank BK, Wakefield AR, Hueston J. Surgery of repair as applied to hand injuries. 4th ed. Edinburgh: Churchill Livingstone, 1973:3-14.
11. Packer GJ, Shaheen MA. Patterns of hand fractures and dislocations in a district general hospital. J Hand Surg (Br) 1993;18(4):511-4.
12. Oleske DM, Hahn JJ. Work-related injuries of the hand: data from an occupational injury/illness surveillance system. J Community Health 1992;17:205-19.
13. Skov O. The incidence of hospital-treated occupational hand injuries. J Hand Surg (Br) 1994;19(1):118-9.
14. Haas JC, Meyers MC. Rock climbing injuries. Sports Med 1995;20:199-205.
15. Kujala UM, Taimela S, Antti-Poika I, Orava S, Tuominen R, Myllynen P. Acute injuries in soccer, ice hockey, volleyball, basketball, judo and karate: analysis of national registry data. BMJ 1995;311:1465-8.