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Susant Mishra

Department of Burns, Plastic & Reconstructive Surgery, IMS and SUM Hospital, SOA University, K8, Kalinga nagar, Bhubaneswar, Odisha, India

Swati Mishra

Department Pharmacology, IMS and SUM Hospital, SOA University, K8, Kalinga nagar, Bhubaneswar, Odisha, India

Blast injury hand: An analysis of 68 cases in an Indian tertiary care teaching hospital

Susant Mishra and Swati Mishra

Abstract

Background: Hand is one of the most important units of our body that carries out the actions that our brain demands and hence losing a hand function is next to losing a life. The purpose of this study is to characterise the severity of each injury, assess the hand function lost, and reconstructive options and rehabilitation at our institute.

Materials & Methods: A retrospective study of patients of blast injuries to the hand admitted to our department was made and analysed from December 2012 through December 2014. The injuries were characterised as mild, moderate or severe with the help of X-rays, clinical presentations, and operative procedures performed. The treatment of these patients during hospital stay was noted, follow up and return of hand function documented.

Results: Sixty-eight patients were evaluated and treated inpatient with blast injuries hand. They were all male (100%), all patients (100%) had their dominant hand involved, with an average age of 27 years. 17 patients had mild injuries, 26 had moderate and 25 had severe injuries. Firecrackers were the most common explosives. All patients were treated surgically (with or without bone fixation). Mean admission time in hospital was 12 days. All patients were followed up for a period of one year and hand functions were assessed. 26 patients regained their hand functions completely while others and 6 patients with amputations had a functional deficit.

Conclusion: Blast injury hand can have devastating consequences from loss of hand function to amputations and each unit of hand must be addressed carefully to preserve these.

Keywords: Social Networking, Corporate Hubs, Internet, Monetary, Benefits, Consumer, Brand, Online Buying

Introduction

As the saying.....

You only have two hands, one to help yourself, second to help others.

Hand is one of the most important units of our body that carries out the actions that our brain demands and hence losing a hand function is next to losing a life.

Firecrackers are used to celebrate Diwali, Christmas, New Year, after matches, during wedding processions and occasionally for inter-rivalry issues. Around these festivals and celebrations, blast injuries result in hundreds to thousands of damages annually.

Most cases these blast injuries occur from firecrackers and homemade bombs, which have a variable blast potential that determines the nature of injury sustained. Plastic surgeons are mostly associated in management of these patients as such injuries involve the hand and associated with burns.

Injuries can be classified into:

- Mild injuries: have only involvement of the soft tissues (no involvement of bone or joints) and have an excellent outcome.
- Moderate injuries: have injuries to bones and joints in addition to soft tissues (but have no amputations of any kind) and the eventual outcome is satisfactory.
- Severe injuries: have amputations of part or whole of the hand, which leads to terminalization operations and amputations in many cases and to severe disability and stiffness.

The purpose of our study is to assess the severity, plan the reconstruction and measure the outcome of the procedures and hand function in long term.

Corresponding Author

Swati Mishra

Department Pharmacology, IMS and SUM Hospital, SOA University, K8, Kalinga nagar, Bhubaneswar, Odisha, India

Materials & methods

Sixty-eight patients admitted to our department from December 2012 to December 2014, were assessed, planned for operative procedures and followed up for a period of two years. A retrospective analysis was done taking into account the clinical notes, x-rays, pre-op and post op photographs, operative procedures performed, follow up notes and physiotherapy and rehabilitation undertaken.

Their profession, incidence of occurrence, socio-economic status was taken into account while jotting down the history. After investigations, patients were classified according to hand injury severity in the operation theatre itself under anaesthesia and patient relatives/patient counselled regarding probable outcomes. Then surgical procedures were undertaken in form of debridements, bone fixation, flap or graft coverage or amputations as required. After discharge, patients were advised for follow up at our OPD at an interval of 15days for a period of 3months and then monthly for nine months. They were also advised to attend Physiotherapy OPD regularly for rehabilitation.

Results

The agents causing blast injuries of the hand were most commonly firecrackers and thread (sutuli) bombs. The blast injuries resulting out of these agents ranged from mild to severe which, was due to the blast potential of the cracker and the vicinity of hand to the firecracker while the patient sustained injury. The injuries were categorised from mild to severe depending upon the soft tissue loss, fractures and dislocations and amputations (Table 1, Fig 1).

Table 1: Severity of Injury and Demographic data.

Age (in years)	Severity of Injury			Total
	Mild	Moderate	Severe	
Less than 10	1	0	0	1
11 to 20	2	8	2	12
21 to 30	12	12	14	38
31 to 40	0	6	6	12
41 to 50	2	0	3	5
Total	17	26	25	68
Literacy				
Literate	9	12	17	38
Illiterate	8	14	8	30
Socioeconomic Status				
Low SES	8	13	15	36
Lower middle Income Group	8	12	8	28
Upper middle Income Group	1	1	2	4
Higher income Group	0	0	0	0

Of our 68 patients treated, all (100%) were male with age range 9-48 years with an average age of 27 years. Majority of injuries sustained were young persons that reflects the socio-economic burden on the society. Most patients (36; 52.9%) were of low socioeconomic status which reflects the unawareness and unpreparedness while indulged in celebrations involving firecrackers. People from upper middle and higher income group were not encountered at our center. Illiteracy was another factor leading to such injuries. The dominant hand was involved in 100% of cases with bilateral hand injury was encountered in only 1 patient (Table 2).



Fig 1a: Moderate blast injury, **Fig 1b:** Severe blast injury, **Fig 1c:** Blast hand, **Fig 1d:** blast hand, **Fig 1e:** Pre-operation, **Fig 1f:** Post Operation, **Fig 1g:** CMC dislocation, **Fig 1h:** The mangled hand following blast and **Fig 1i:** Xray showing mcp fracture and dislocation

Table 2: Description of Blast Injury sustained

Lacerations only	17 (25%)
CMC Joint Dislocations	26 (38.2%)
MCP joint Dislocations	10 (15.4%)
Metacarpal Fractures	16 (23.5%)
Finger amputations	19 (28%)
Mangled Hand requiring amputations	6 (8.8%)

The most common pattern of injury found in patients was dorsal dislocation of the 1st metacarpal with a first web space laceration associated with injuries to the thenar muscles. This was associated mostly with other finger lacerations or tip amputations. More severe injuries leading to amputations of fingers, metacarpal fractures and soft tissue loss of other units of hand were less common. However, these severe injuries and mangled hands lead to difficulties in reconstructions and hence, return of hand function was not predictable.

Radial aspect of hand was involved in all cases while the central and ulnar aspects were comparatively less injured.

Two patients had auto amputation of the whole hand at admission and a total of six patients underwent amputation at the level of the wrist joint or below elbow as salvage of hand was not possible. The operative procedures i.e. debridement, suturing, bony fixation and flap coverage were taken up in the same sitting in view of early mobilisation and rehabilitation. Many flaps were used for wound coverage with the groin flap being the most common (21 cases) followed by hypogastric flap (2 cases) and posterior interosseous artery (PIA) flap (1 case). No microsurgical procedure was done for finger reconstruction considering the severity of injury and probable low rate of success in these cases. All these patients were managed with post-operative physiotherapy starting two days following the operative procedure.

Associated with the blast injury hand were other injuries, the splinter injuries (41.2%) being most common followed by burns (26.5%). Other injuries included injuries to the face (17.6%), the upper extremities (13.2%), and the lower limbs (1.4%). No visceral injury was noted in any of the patients (Table 3).

Table 3: Injury type and their surgery with average hospital stay

Injury type & Number of Patients	Surgical Procedures Performed	Average Hospital Stay (In Days)	Hand Function At 1 year			Return to Occupation (in months)
			Normal	Moderate Impairment	Severe Impairment	
Mild (17)	Debridement and dressing (8)	5	8	0	0	less than 1
	Debridement and suturing (9)	9	9	0	0	less than 1
Moderate (26)	Debridement + thumb fixation (k wires) +/- flap coverage (10)	10	8	2	0	2
	Debridement + thumb fixation (k wires)+ finger fixation (k wires) +/- flap coverage (15)	18	1	10	4	3
	Debridement + thumb fixation (k wires)+ finger fixation (miniplates)+/- flap coverage (1)	18	0	1	0	6
Severe(25)	Amputations (below elbow or wrist level) (6)	12	0	0	6	0
	Thumb/Finger Amputations only (at IP/MCP/CMC level) (19)	10	0	8	11	12

Of our 68 patients treated, mild injury was noted in seventeen (25%) cases; moderate in twenty six (38.2%) and severe in twenty five (36.8%) cases. 55.9% patients were in the age group of 21-30 years and 36.8% had sustained severe injuries in our series.

An analysis of the range of motion (ROM) of the fingers following rehabilitation revealed that the ROM was closest to normal in patients with mild injuries with gradual deterioration of function in moderate to severe injuries. The length of hospital stay was the shortest in patients with mild injuries but was more than 2 weeks in patients with moderate and severe injuries. Stiffness was marked with metacarpal and phalangeal fractures and dislocations. A one year follow up in patients with mild to moderate injuries revealed a satisfactory functional regain and return to work while those with severe injuries had disabilities even at the end of one year period. Literacy was an important factor as the literate adhered more to extensive physiotherapy and regular follow ups compared to the illiterate.

Discussion

The treatment modalities of a blast injury to the hand can be quite challenging and has been outlined earlier. Here, we attempt to investigate the cause, plan a treatment, take into account the social status, follow up the patient for a significant period and work for any hand function deficits.

The most common pattern of injury comprised of a first web space split with thenar muscle injury, dorsal dislocation of the CMC joint, sometimes associated with other finger injuries. The hand comprises of 4 discrete units of which the thumb is the most mobile owing solely to the mobility of the CMC joint which is bisaddle in nature. The index finger is the next most mobile unit attached to the fixed unit of the hand comprised of the central metacarpals. The rest of the fingers and the metacarpals take part in power grip of the hand.

The center of the hand comprises of 2nd and 3rd metacarpals fixed to the carpus in the hand and their shafts become the weakest target and are subject to fracture from the effect of the blast. The radial aspect of the hand was most commonly affected in a case of blast injury to the hand in our series. The brunt of injury was the highest to the thumb gradually decreasing to the center of the hand and to the ulnar side.

Revascularization and replantation in blast injuries were not feasible options considering the severity of the injuries. We opted for minimal amputations considering maximal hand functions wherever feasible rather than concentrating on replantations. The operative procedures i.e. debridement, suturing, bony fixation and flap coverage were taken up in the same sitting in view of early mobilisation and rehabilitation. We preferred operating on patients in the same sitting rather than doing serial debridements and waiting for the wound to granulate to put grafts/flaps, and had no

complications arising thereof in our series. Groin flap was the workhorse flap in our series that was reliable for both dorsal and palmar aspects of hand, coverage of degloved fingers and 1st webspace creation. However, the groin flap always required a secondary thinning. All patients were subjected to intensive physiotherapy 48 hours post operative procedures till they were discharged and regularly followed up at our department for evaluation and physiotherapy. Toe to thumb transfer was done for a patient who had a groin flap to cover the thumb at IP joint, but he preferred a different institute and followed up to us. Stiffness persisted in patients in the post-operative phase in those with severe injuries, which was resistant to physiotherapy.

Conclusion

Blast injuries of the hand can have a spectrum of consequences ranging from stiff hand and hand amputations to psychosocial impacts. Patients who had inadequate hand function even at the end of one year of procedure had difficulties in managing their jobs leading to psychological disturbances and social withdrawals. So, it is the primary duty of the physician to refer such patients to a center equipped to manage hand emergencies. The surgeon and the society also need to take a lead role to educate patients on grievous consequences of blast injuries hand and their prevention.

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