

Study of relation of type of fracture with amount of postoperative fluid therapy and duration of hospital stay after surgery

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Abstract

Background: Post-earthquake in Nepal many patients were rescued by the Nepalese Army and transferred to Shree Birendra Hospital where they were managed and discharged postoperatively to the area with substandard care.

Objectives: This study aimed to establish the relation of type of fracture with the amount of fluid infused/transfused and postoperative hospital stay during earthquake victim resuscitation and care in April 2015.

Methods: Hospital based data registered during the period of 25th April 2015 to 15th May 2015 were collected for this analytical study design. Seventy-five orthopaedic cases were selected randomly and analysed with software Minitab 17.

Results: Fifty-three patients had long bone fractures, out of which 32 were infused with low, 18 with moderate, and three with high amounts of fluids. Similarly, 15 patients with non-long bone fractures were infused with low and seven patients with moderate amounts of fluid. The Chi-square association between type of fracture and amount of postoperative fluid therapy is 1.418, DF = 2 with $p = 0.49$. Similarly, the Chi-square association between the type of fracture and duration of hospital stay is 5.423 with DF = 4 and $p = 0.247$.

Conclusion: Long bone fractures are more debilitating but are not a cause for long hospital stay postoperatively. And there is no significant relationship between the type of fracture and the amount of postoperative fluid therapy. Hence during the time of disaster, patients can be cared for in the hospital ward for a certain time and shifted to other areas of sub-standard care. This in turn can accommodate large victims during such critical times.

Key words: Bone; Earthquake; Fluid therapy; Trauma.

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INTRODUCTION

The Government reported that a total of 505,745 houses were destroyed and 279,330 were damaged by the 7.8 magnitude earthquake on the 25th of April 2015 and the 7.3 magnitude quakes on the 12th of May 2015.¹ The earthquakes took the lives of 8,702 people and injured thousands.¹ The disaster in the country led to national chaos and national and international attention rose to reduce the burden. Shree Birendra Hospital, Chhauni is a tertiary care hospital where all victims including the ones rescued by the Nepalese Army as well as referral cases from various centres were managed. Medical emergencies including fractures, perforation of viscera, infected wound, blunt trauma, penetrating injuries, etc. presented to the hospital.

Fracture of bone was the most common injury during the disaster which could have led to various other

complications if left unmanaged. Major surgery places an increased burden of aerobic metabolism upon the patient and postoperative outcome depends on peak exertional oxygen consumption and anaerobic threshold which depends on haemoglobin concentration.^{2,3} The audit of blood revealed that 40% perioperative transfusion rate in orthopaedics is for joint replacement and trauma.⁴ The pre-hospital care team should work to prevent further injury, transport the patient to the hospital as rapidly as possible and initiate appropriate treatment in the field.⁵

After completion of surgery, patients closely monitored constantly to address likely complications after which they were discharged based on criteria including stable vitals, tolerance of oral intake, recovery of lower gastrointestinal function, adequate pain control with oral analgesia, ability to mobilise and self-care, no evidence of complications or untreated medical conditions, adequate post-discharge support, and patient's willingness (hospital protocol). However, the exact protocol for discharge is unknown and days of hospital stay are also not defined in any previously done study. Therefore, this study intended to observe the length of hospital stay or stay at standard treatment facility for optimal treatment and then discharge to home or sub-standard facility (holding area) without risk of fatalities. This study is believed to be helpful in deciding the severity of fracture for patient counselling, developing postoperative discharge timing during disasters, ethical postoperative use of IV fluids and best utilisation of limited sources in the context of Nepal.

METHODOLOGY

This is a retrospective observational analytical correlational study which included 75 earthquake victims brought to the Department of Orthopaedics of Shree Birendra Hospital with fractures between 25th April 2015 and 15th May 2015. The subjects were randomly selected from the hospital record section with permission from the department. Secondary data were collected from the hospital records, which included hospital admission form, daily treatment logbook, nursing reports, operation theatre reports and discharge summary. The conceptual framework for the study is as represented in Figure 1. Data collected were processed using software Minitab 17.

The ethical clearance was obtained from Nepal Health Research Council Ethical Review Board (Ref no: 245) on

5th September 2014. Potential biases included under-coverage bias, reporting bias, measurement bias, and implicit bias.

The objectives of the study were to assess the frequency of fracture as per age and sex; to report types of fluids infused; to establish the relation between types of fracture; amount of fluid infused and postoperative hospital stay. Out of all the patients managed during the study period, only 75 cases were selected from the hospital record section with permission from the department for observational analytical correlational study. Based on the inclusion criteria of patients with fractures treated in the orthopaedics department only and availability of records in the record section, the size of the sample was determined. Sample size was not calculated. The data thus collected were both qualitative and quantitative, and analysis was done using software Minitab 17.

RESULTS

The frequency of fracture was higher in children below the age of 20 years, followed by people of age group 20 to 30 years. In the age group of 20 to 30 years, males were three times more affected than females. Traumatic fractures of long bones were more than non-long bones (Figure 2) and among all the fractures, 51 cases (68%) were fractures of the tibia.

Out of the total cases, 49 patients (65%) underwent surgical intervention, 19 patients (25%) were conservatively managed and the rest were managed with incision and drainage with wound closure.

During the management of patients, IV fluids (N/S, R/L, DNS, Dextrose+ KCL, Hemacele), oral fluids, whole blood, and packed cell volume were given.

No association was found between fracture type and amount of fluid transfused ($\chi^2(2) > 1.418, p = 0.49$) presented in Table 1.

No association was found between fracture type and duration of hospital stay ($\chi^2(4) > 5.423, p = 0.247$) presented in Table 2.

The study shows that longer patient stay in hospital is related to more fluids being transfused to the patient ($\chi^2(8) > 18.372, p = 0.018$) presented in Table 3.

Table 1: Type of bone fracture and amount of IV fluid

Types of fracture	Amount of IV Fluid (ml)		
	Mild (<4000)	Moderate (4000-8000)	Severe (> 8000)
Long bone fracture	32 (42.7%)	18 (24%)	3 (4%)
Non-long bone fracture	15 (20%)	7 (9.3%)	0

Table 2: Relation between duration of hospital stay and type of fracture

Duration of hospital stay	Type of fracture, n (%)	
	Long bone	Non-long bone
Not stayed	5 (6.7)	6 (8)
1-2 days	12 (16)	6 (8)
3-4 days	20 (26.7)	4 (5.3)
5-6 days	5 (6.7)	2 (2.6)
>6 days	11 (14.7)	4 (5.3)

Table 3: Amount of IV fluid therapy and postoperative hospital stay

Amount of fluid	Days of postoperative hospital stay (days)				
	0	1-2	3-4	5-6	>6
4000 ml	9	16	14	2	6
4000-8000 ml	2	2	10	4	7
>8000 ml	0	0	0	1	2

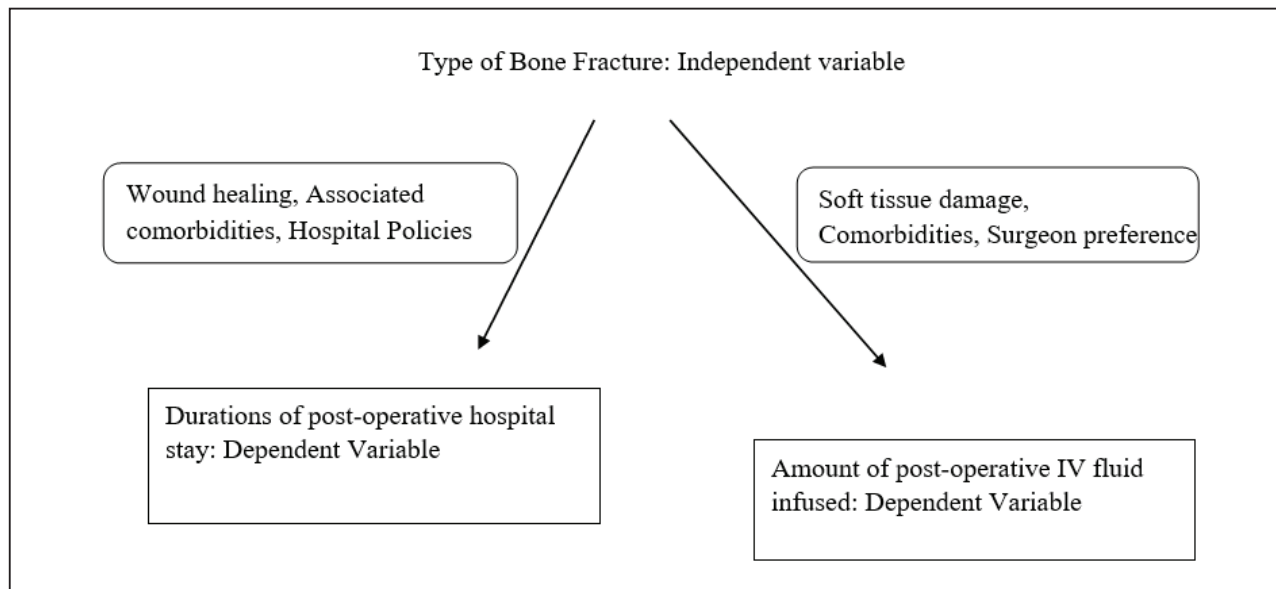
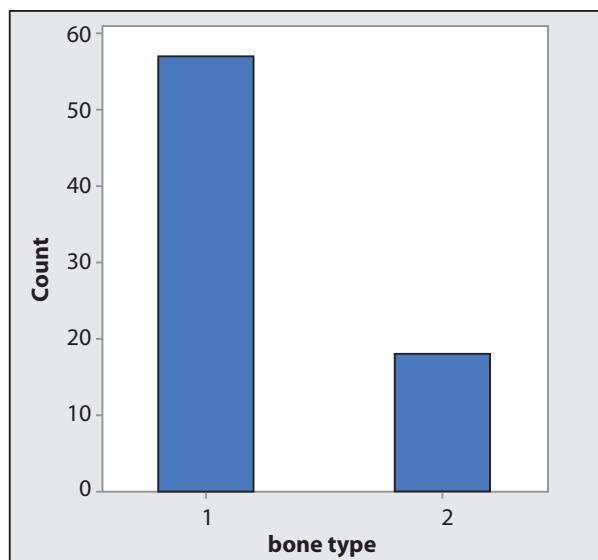


Figure 1: Conceptual framework of the study



1. Long bone fracture including fracture of tibia, fibula, femur, humerus, radius, or ulna.
2. Non-long bone fracture including fracture of bone except long bones.

Figure 2: Types of bone fracture

DISCUSSION

The type of injury caused during a disaster is based on various factors like personal factor, environment and geographical factor⁶. Among the injuries the vast majority are of orthopaedics origin.⁷⁻¹⁵ Non-orthopaedic injuries to the head, chest, and abdomen account for 13% of injuries after earthquakes and are usually considered to be non-survivable.⁷ Bozkurt et al.¹⁶ noted that most tibial fractures (84%) after the 2005 Pakistan earthquake involved the middle and distal tibial shaft as opposed to the proximal tibia or tibial plateau. While in this study, long bone fracture was three times more than non-long bone fracture. Fracture of tibia was 68% which implies that during disasters fracture of tibia is the most common fracture. Most of the cases in the SBH were managed by surgery during the study period.

In the massive earthquake, it is often unrealistic to pursue definitive internal fixation, so damage-control orthopaedics (DCO) may be the approach of choice until definitive fixation is possible. The focus should be on haemorrhage management, wound debridement, infection control, and soft tissue stabilisation¹⁷ which was done in our facility. External fixation is key to proper management of fractures and soft tissue stabilisation, providing favourable results in earthquake disaster scenarios.¹⁸⁻²⁰ The ratio of open reduction and internal fixation (ORIF) and external fixator also depends on the rapidity of rescue done. In the Haiti earthquake of

2010, the Israeli Defence Force reported that it required approximately two weeks for an adequate number of treatment centres to be established to allow definitive fixation. They also noted that the use of external fixation and, when necessary, amputation, as a means of DCO allowed fractures to be definitively addressed later by more sufficiently staffed and supplied treatment teams or allowed patients to be transported to better-equipped facilities.²⁰ A retrospective study after that earthquake reported that in 295 of 1145 fractures (26%), reductions were achieved with external fixation¹⁸. In our study, fracture of bone is managed either conservatively or interventions are done ranging from simple irrigation and debridement to major surgeries like closed reduction and external or internal fixation depending upon the fracture characteristics.

Fracture of bone is always followed by haemorrhage which further increases during surgical intervention. Based on WHO criteria of haemorrhage, fluid or blood are to be given both pre and postoperatively which directly affect treatment outcome.

The goal of IV fluid is to restore normal circulation in the body which can jeopardise post-surgery due to blood loss and patient being nil per oral. The restoration of fluid will help to maintain oxygenation of the tissue.^{21,22} Pre-operative fluid management is central to prevent intraoperative hypovolemia and dehydration. Multiple studies allow clear fluid intake two hour prior to the surgery.^{23, 24} In this study three patients with long bone fractures were only infused with IV fluids and the rest of the fractures with mild and moderate amounts of IV fluids. Only nine patients required whole blood transfusion (total of 4550 ml of blood) and two patients required packed cell volume (700 ml) postoperatively. Most patients were infused with IV fluids of which Ringer lactate and normal saline were predominant.

However there is still no consensus on the right fluid therapy on the ward or which parameters to monitor, and local guidelines are often absent.^{25, 26} It has also proven complex to organise care in such a way that evidence-based therapies are adopted. Monitoring body weight and fluid balance is often neglected or not registered properly.^{27, 28} A meta-analysis has also concluded that appropriate preoperative fluid therapy strategy reduces postoperative complications, but not perioperative mortality, irrespectively of perioperative overall amount of fluids infused.²⁹ Makaryus et al. also mentioned that preoperative as well as intra operative fluid therapy is important to decrease overall morbidities and mortalities but, in the postoperative period, patients

should be encouraged to start per oral hydration early, and excessive IV fluid administration should be avoided.³⁰

Postoperative hospital stay is defined as the time from the date of the index operation to the date of discharge, transfer to a subacute service, or death, whichever came first.³¹ Eyad Issa et al. have shown the median postoperative hospital stay was three days (interquartile range 2-5), and 62.3% of patients were discharged within three days of surgery.³² Prolonged duration of hospital stay is associated with preoperative, intraoperative, and postoperative factors.³¹ Another study says preoperative pulmonary infection, ASA score 3/4, and utilization of catheter after surgery were statistically significant contributors in postoperative complications.³³ Therefore, to reduce costs, efforts should be made to improve the intraoperative process of care and to minimize postoperative complications.³¹ In this study rapid earthquake relief by Nepalese Army, prompt and standard pre- and intra-operative care might have contributed to early recovery and reduced postoperative hospital stay.

This study however has few limitations as the data collected are not inclusive and do not represent total

population treated during earthquake; the criteria for defining types of fracture, infusion/ transfusion, and discharge are not universal; adequate clinical parameters are not included and pre-operative management are not mentioned.

CONCLUSION

The study shows that there is no relation between the type of fracture and amount of fluid therapy. But there was a positive relation with fluid therapy and postoperative hospital stay suggesting more hospital stay requires more fluids. However, adequate, appropriate, and effective pre-operative management of cases might contribute to the better postoperative outcome and patients undergoing surgery can be discharged early to accommodate the large number of patients during their critical time without compromising patient condition.

Since this type of study has not been done previously to our knowledge, the result can be used as the baseline result for further studies to develop optimal hospital management of surgical cases.

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