

Does the right leg require extra protection? Five-year review of type 3 open fractures of the tibia

Y Imran, T Vishvanathan

ABSTRACT

Introduction: Open fracture of the tibia is very common among motorcyclists. The morbidity associated with this injury is well-documented as treatment of severe open fractures is very difficult. There is currently no study done in the literature to see the relationship between fracture severity and the side of the injury.

Methods: We reviewed 239 patients with open fractures of the tibia admitted to our institution from 1998 to 2002.

Results: From 241 tibias studied, 150 (62.2 percent) involved the right side and 91 (37.8 percent) involved the left side. Statistical analysis showed that there was a significant difference in the severity of open fracture between the sides of fracture. Less severe injury (grades 1 and 2 fractures) was associated with injury of the left tibia and severe injury (grades 3A, B and C fractures combined) was associated with right tibia fracture.

Conclusion: Since the right leg was more exposed to the injury, it is imperative to protect the limb. This may reduce the overall incidence and severity of tibia fractures.

Keywords: fracture, open fracture, road accidents, tibia, tibial fracture

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INTRODUCTION

Motorcycle-related road accidents is a leading cause of morbidity and mortality in Malaysia. Approximately 35% to 40% of all motor vehicle accidents (MVA) involved the motorcyclists, and 50% to 60% of deaths due to MVA involved motorcyclists⁽¹⁾. Many campaigns on road safety have been conducted to minimise the incidence of deaths. Fatality and morbidity are high, especially among teenagers and young adults. Fracture of the tibia has been shown to be the commonest injury associated with motorcyclists⁽¹⁾. Dangerous driving may predispose the right leg to be injured more

frequently or more severely, compared to the left side among motorcyclist. Since road users drive along the left lane, it was thought that the right lower limb is more exposed to the oncoming and the overtaking vehicles. However, it is not known whether the right leg is truly more vulnerable to the injury. Understanding its cause will be helpful in minimising the incidence and the severity of the injury. As open tibia fracture is commonly encountered and the management of this fracture is difficult, protection of the vulnerable limb may at least reduce the severity if not the overall incidence of open tibia fracture.

METHODS

This is a retrospective review of patients who were admitted to Hospital Universiti Sains Malaysia for open fracture of the tibia, from January 1998 to December 2002. The patients' data were obtained from the operation theatre registry. The patients analysed were those who had sustained open fracture of the tibia with injuries of grades 1, 2 and 3, according to the Gustillo-Anderson classification. The cohort was divided into two groups, namely: right tibia fractures and left tibia fractures. They were subdivided into their severity of fractures. Those who had grade 1 and 2 open fractures were grouped as "less severe injury" and those who sustained grade 3 open fracture were grouped as "severe injury". The incidence of different severity of fractures of each side were compared and analysed statistically, using the Pearson chi-square test (SPSS software version 11).

RESULTS

In the five-year period between 1998 and 2002, 239 patients with 241 tibia (two patients had bilateral tibia fractures) were admitted to our hospital for the management of open fracture of the tibia due to motorcycle-related MVA. Two hundred and one (84%) were male patients and 38 (16%) were female patients. The patients aged between 11 to 20 years old had the highest incidence of open fracture (34.7%), both in male and female patients. The youngest patient involved was a four-year-old boy (a pillion rider) and

Department of
Orthopaedics
School of Medical
Sciences
Universiti Sains
Malaysia
16150 Kubang Kerian
Kelantan
Malaysia

Y Imran, MD, MMed
Lecturer

T Vishvanathan,
MBBS, MMed
Lecturer

Correspondence to:
Dr Imran Yusof
Tel: (60) 9 7663000
ext: 4518
Fax: (60) 9 7653370
Email: drimran93@
yahoo.com

Table I. Incidence of open fractures of the tibia according to age group.

Age (in years)	Male no. (%)	Female no. (%)	Total no. (%)
<10	16 (6.7)	5 (2.1)	21 (8.8)
11-20	65 (27.2)	18 (7.5)	83 (34.7)
21-30	46 (19.2)	4 (1.7)	50 (20.9)
31-40	18 (7.5)	4 (1.7)	22 (9.2)
41-50	23 (9.7)	2 (0.8)	25 (10.5)
51-60	12 (5.0)	3 (1.3)	15 (6.3)
61-70	9 (3.8)	2 (0.8)	11 (4.6)
>70	12 (5.0)	0 (0.0)	12 (5.0)
Total	201 (84.1)	38 (15.9)	239 (100)

the oldest was aged 84 years old (Table I). From 241 tibias studied, 150 (62.2%) involved the right side and 91 (37.8%) involved the left side. Seventy-four (30.7%) of 241 tibias were classified as grade 3 fractures (severe injury). Others (69.3%) were grade 1 and 2 open tibia fractures (less severe injury).

Statistical analysis showed that there was a significant difference in severity of open fractures according to the side of fracture (Pearson chi-squared = 9.195, df=3, p value = 0.027) (Table II). Less severe injury (grades 1 and 2 fractures) was associated with injury of the left tibia, and severe injury (grades 3A, B and C fractures combined) was associated with right tibia fracture. Open fracture grade 3C of the right tibia was more common than the left tibia. There was no open fracture grade 3C of the left tibia seen in this series.

DISCUSSION

Motorcycle-related road accident is a leading cause of morbidity and mortality in Malaysia⁽¹⁾. Motorcyclists are especially vulnerable and the lower limbs are the most commonly injured^(2,3). Many studies involving the motorcyclists had been reported because of the high morbidity and mortality associated with them⁽¹⁻³⁾. Improper helmet application, education level, engine

capacity and period of licensee were shown to be important contributing factors towards their fatalities^(3,4). Fracture of the tibia and fibula is the most common fracture associated with motorcyclists, constituting 43.5% of all fractures⁽²⁾. Open fracture of the tibia is more common than other fractures of the limbs because of its superficiality. The complications associated with open fracture, including non-union, osteomyelitis and limb loss, are common in tibial injury, especially in grade 3 open fractures. Management of this condition is problematical and frequently disappointing⁽⁵⁾.

This study has shown that open fracture of the right tibia was significantly more frequent and more severe compared to the left side. Open fracture grade 3 of the right tibia was found to be three times more common, and all the patients with grade 3C open fracture observed in the study involved the right tibia. Type 3c open fracture is associated with a high rate of amputation. Salvaging grade 3 complicated tibia fractures is difficult and is not widely performed. In another prospective study done in Edinburgh, Bradbury and Robertson had found that the right arm and leg were injured twice as often as the left side among motorcyclists⁽⁶⁾. There is no other similar study reported in the English-language literature for further comparison.

For riders who drive on the left lane e.g. in Malaysia and in the United Kingdom, the right leg or other extremities are more vulnerable to severe injuries. This is probably because they are more vulnerable to the on-coming vehicles. The right leg is also more "exposed" to vehicles overtaking from the right. In our country, it is not uncommon to see motorcyclists overtake other vehicles from the left, which makes their right leg more vulnerable to injury if they hit the vehicles in front.

MVA involving motorcyclists involved all age groups. The age group between 11 to 20 years old, involving both sexes, constituted the highest group at risk. Patients as young as four years old and as old as 84 years old were involved in the injury, as shown by the current study. This indicates that motorcycles are

Table II. Cross-tabulation of fracture severity.

		Fracture severity				Total	
		Grade 1-2	Grade 3a	Grade 3b	Grade 3c		
Fracture side	Right	Number	94	28	19	9	150
		% within fracture side	62.7%	18.7%	12.7%	6.0%	100.0%
Left	Number	71	12	8	0	91	
	% within fracture side	78.0%	13.2%	8.8%		100.0%	
Total	Number	165	40	27	9	241	
	% within fracture side	68.5%	16.6%	11.2%	3.7%	100.0%	

a very important and widely-used mode of transport in our country because of its affordability and practicality. Riders and pillion riders carry similar risk for lower limb injuries⁽⁷⁾. Serious head injury is inevitable as the appropriate size helmets are not easily available for the young pillion riders, especially those below seven years old, even though they are commercially-available. It was reported that only 54.4% of motorcyclists used helmets properly and 24.2% did not wear helmet at all, especially on rural roads⁽⁴⁾.

Protection of high-risk organs is potentially effective in minimising the severity of an injury. It has already been shown that the incidence of severe head injury has been reduced with proper helmet use⁽⁸⁾. The right leg should also be protected in order to reduce the number of severe open tibial fractures. The severity of right leg injury may be minimised by a specific "leg guard", for example, a special attire or boot to be worn while riding. Research on an appropriate material for this should be initiated. The motorcycle can also be equipped with a special protective bar in front, to protect the leg⁽⁹⁾. Providing one-way separate lanes for motorcyclists may reduce injuries as well.

Other preventive measures include formal education with regards to the road traffic law, and stricter implementation of the present regulations may be effective for young riders as they are relatively-easily educated. The minimum age limit for driving license application should be increased from 16 years to above 20 years old. This is to ensure that they are mature enough to ride, and this will also reduce the traffic load. Nearly one-half of the MVA victims (43.5%) are below 20 years old, as shown by the current study. Maximum speed limits, especially for low-capacity motorcycles, should be revised as well. This study indicates the need for a prospective and multicentre study in order to get more randomised data, and

therefore more accurate results. The dominant side of the person may influence the side and severity of the injury among the motorcyclists. Other important risk factors might then be discovered.

In conclusion, the incidence of open fracture of the right tibia is significantly more frequent and more severe compared to the left side. Since the right leg is more exposed to the injury, it is imperative to protect the limb. Protection of the right tibia may reduce the overall incidence and severity of the tibial fractures.

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