



Comparison of severity and pattern of injuries between motorcycle riders and their pillions: A matched study

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ABSTRACT

Introduction: Motorcyclists and their pillion riders are the most vulnerable group of road users in Singapore, accounting for 50% of all road traffic accident fatalities in 2011. This study aims to compare the severity and pattern of injuries between matched pairs of riders and pillions.

Methods: Thirty-two matched pairs who presented to the A&E of an urban hospital from 1 August 2011 to 20 March 2012 were enrolled. Data were obtained from the hospital's trauma registry records, clinical records and accident victims were interviewed individually. Analysis was done using Stata 10 and considered rider–pillion pairs.

Results: Thirty-one pairs agreed to participate. There was no statistically significant difference in the ISS between riders and pillions ($p = 0.25$). There was no significant difference in the probability of survival, Revised Trauma Score, distribution of injuries, total duration of admission and ICU stay between riders and pillions. When one party of the matched pair sustained a head, face, thoracic, abdominal/pelvic, extremity or external injury, the likelihood that the other party had an injury in the same region was 31%, 14%, 10%, 14%, 56% and 68% respectively. Cohen's kappa values were 0.28, 0.15, 0.05, 0.17, 0.24 and -0.16 for the respective regions.

Discussion: By comparing the severity and pattern of injuries between naturally matched pairs on the same motorcycle, one can account for potential confounding by the type and impact of collision, rider experience, amount of time to availability of medical aid, and other factors that may influence the outcome. Our study shows no statistically significant difference in the ISS and distribution of injuries between riders and pillions of matched pairs. Therefore, future health and insurance policies should provide equal coverage for both riders and pillions. Medical practitioners should approach riders and pillions similarly as there is no significant difference in their injury distribution. When one party of a matched pair presents with a head, extremity or external injury, care should be taken to look for an injury in the same region in the other party.

Conclusion: Our study shows that there is no statistically significant difference in the ISS of riders and pillions. The pattern of injury is also similar. This study provides us useful information in the clinical management of motorcyclists and their pillions.

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Introduction

Singapore is a city-state with a resident population of 5.18 million and a limited land area of 684.1 km². To prevent uncontrolled growth in the number of vehicles which will result in traffic congestion in land and road scarce Singapore, the Government encourages the use of its well-developed public transport system. Measures to manage car ownership and usage

implemented by the government make the cost of owning and driving a car in Singapore very expensive.¹ Motorcycles are the most affordable form of personal transport in Singapore. Therefore, they are a significant means of daily transportation in Singapore. In 2011, motorcycles formed almost one-fifth of the total number of vehicles registered in Singapore.²

All motorcycle riders and their pillions are required by law to wear a helmet while riding motorcycles. Despite this law and continued efforts by the Traffic Police in inculcating safe riding habits, motorcyclists and their pillion riders are the most vulnerable group of road users, accounting for about 50% of all road traffic accident fatalities in 2011. The Traffic Police department reported that of the 197 fatalities in 2011, there were 99

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fatalities involving motorcyclists and their pillion riders, an increase of 11.2% from the 89 fatalities recorded in 2010.³ Thus, this group of road users continues to be a cause of concern for the Government as well as the medical teams involved in the management of their injuries.

Current literature on motorcycle accidents focuses mainly on comparison of injuries between unmatched motorcycle riders and pillions, where riders and pillions from different accidents were aggregated together and analysed.^{4–6} In contrast, a matched study is one where every motorcycle rider is matched with his pillion (the passenger on the same motorcycle involved in the same accident), after which matched analysis is done on these matched pairs. The severity and distribution of injuries of matched pairs of riders and pillions has not been well studied. By estimating effects among naturally matched pairs, we can account for potential confounding by the type and impact of collision, motorcycle characteristics, rider experience, amount of time to availability of medical aid, and other factors that may influence the outcome.

Tan Tock Seng Hospital (TTSH) is strategically located in the centre of Singapore and receives the highest number of trauma patients each year. It is a 1400-bedded acute care hospital which functions as a Level 1 trauma centre for the region. In 2011, a total of 434 patients with injury severity scores (ISS) of more than 16 were admitted. This study aimed to compare the severity and pattern of injuries between matched pairs of motorcycle riders and their pillions presenting to the TTSH Emergency Department (ED).

Methods

A prospective study was conducted from 1 August 2011 to 20 March 2012. Thirty-two matched pairs of motorcyclists and their pillions who presented to the TTSH ED after road traffic accidents (RTAs), where at least one member from each pair were admitted to hospital were enrolled in our study. Each matched pair consisted of a motorcycle rider and his pillion who were on the same motorcycle involved in a RTA. A 'rider' refers to the driver of the motorcycle and a 'pillion' refers to a passenger seated behind the rider. All pairs recruited were confirmed matched pairs.

Data were collected from the hospital's Trauma Registry records, clinical records and patient interviews. Verbal informed consent was taken and all agreeable patients were then interviewed either in person or over the telephone. Interviews were conducted by one interviewer using a standardised questionnaire to minimise interviewer bias. Data collected included demographics, riding experience, nature of accident, type and distribution of injuries, initial physiologic parameters at the ED, operative care required, intensive care unit (ICU) or high-dependency (HD) stay required, length of stay in hospital and outcome.

Scoring systems were used in the classification of the type and severity of injuries of these patients. These included the Glasgow Coma Scale (GCS), the Abbreviated Injury Scale (AIS)⁷ and the Injury Severity Score (ISS). The most current AIS scoring system (AIS 2005 Update 2008) was used. From these, the Revised Trauma Score (RTS) and the probability of survival (Ps) were calculated. The scores between riders and pillions of the matched pairs were compared, and the ISS was used to determine outcome (whether riders or pillions were more severely injured). The ISS was computed according to the method described by Baker et al.⁸ The distribution of injuries between riders and pillions were also compared.

Data collected were entered into Microsoft Excel. Analysis was then done with the help of a statistician using Stata (version 10.1) and considered rider–pillion pairs. The distribution of the continuous variables among pairs was compared using the Wilcoxon's Signed-rank test. Categorical variables were analysed

using the McNemar's Chi-square test. Level of significance was taken at 2-sided p -value < 0.05 . In addition, the probability of the other party in a matched pair having an injury in region x when one party has an injury in the same region was calculated using those pairs with at least one party having the injury as the denominator, where x refers to either of these six respective regions: head, face, chest, abdomen/pelvis, extremity or external. The extent of the agreement that both riders and pillions have the same outcome for an injury in each region after taking the magnitude of agreement that would be expected by chance into account was also determined using Cohen's kappa analysis.

Results

Eighty-one percent of the matched pairs consisted of a male motorcyclist and a female pillion and the remainder (19%) had both male motorcyclist and pillion. Most of the motorcyclists and their pillions were friends (48%) or husband and wife (35%). The study had 12 pairs who were both Malay. 11 pairs had a Chinese rider and 6 pairs had an Indian rider. Riders were generally older than pillions, with a mean age of 40 years as compared to 33 years. The mean number of years of riding experience was 15 years. Only 4 riders (13%) held provisional licenses (riding experience of less than one year).

The most common type of accident in our study involved collision with a car (14 pairs, 45%), self-skid accidents (29%) and collision with a bus, lorry or van (16%). Nine pairs (29%) sustained the impact of collision on either side of the motorcycle, 9 pairs (29%) self-skidded and 8 pairs (26%) were involved in head-on collisions. Only 1 pair was hit from the rear end, 1 pair collided into a sand pile and 1 pair was involved in a multiple-collision accident. The median speed (range) of the motorcycles at the time of accident was approximately 60 km/h (15–90 km/h). All the pairs sustained blunt trauma as the primary injury type and only 1 pair (both the rider and pillion) had concomitant penetrating injury. Four pairs (13%) and 2 pairs (6%) had at least one member who consumed alcohol or drugs less than 24 h before the accident respectively. Ten riders (32%) took some form of evasive action during the accident, such as trying to slow down or swerve. The median (interquartile range (IQR)) amount of time taken for transfer to hospital was 39 min (30–58 min) (Table 1).

There was no statistically significant difference in the ISS, Ps and RTS between riders and pillions of matched pairs ($p = 0.25, 0.57, 0.32$ respectively). There were no cases of mortality in our study. The ISS of all victims of our study were low (less than 15). There was also no statistically significant difference between riders and pillions of matched pairs in these parameters compared: GCS, number of regions injured, total duration of hospital admission, duration of Intensive Care Unit (ICU) stay, number of surgeries required, duration of medical leave required and number of types of follow-up (e.g. General Surgery, Orthopaedic Surgery, etc.) required. However, pillions required a longer higher dependency stay when compared to riders ($p = 0.04$) (Table 2).

There was no statistically significant difference in the distribution of injuries among riders and pillions. In matched pairs, riders and pillions do not have different proportions in sustaining injuries to the head, face, chest, abdomen/pelvis, extremities and external regions (all p values > 0.05 using McNemar's test).

When one party of the matched pair sustained a head, face, thoracic, abdominal/pelvic, extremity or external injury, the probability that the other party had an injury in the same region was 31%, 14%, 10%, 14%, 56% and 68% respectively. Cohen's kappa values were 0.28, 0.15, 0.05, 0.17, 0.24 and -0.16 for head, face, chest, abdominal/pelvic, extremity or external injuries respectively (Table 3).

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