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## Motorcycle Related Cranio-Maxillofacial Injuries at a Tertiary Hospital in the Philippines

### ABSTRACT

**Objective:** To describe the type and determine the number of motorcycle related cranio-maxillofacial injuries that were seen by the ORL service in the emergency room of a tertiary hospital from January 2013 to December 2013.

### Methods:

**Design:** Cross sectional retrospective chart review

**Setting:** Tertiary National University Hospital

**Participants:** One hundred nine (109) charts of patients seen at the emergency room from January 2013 to December 2013 were reviewed

**Results:** Of the 109 charts of patients involved in vehicular accidents, there were 76 documented cases of motorcycle related accidents. Of these, 91% involved males and 9% involved females. Seventy one percent (71%) did not wear helmets, of whom 36% were young adult males between the ages of 18-30 years. Those that wore helmets had a total of 27 different facial fracture sites: 19% zygomatic tripod fractures, 15% temporal bone fractures and 11% with no fractures noted. Among those who did not wear helmets 75 fractures were noted. Twenty four percent (24%) were tripod fractures, 15% temporal bone fractures and 12% maxillary fractures. Only one did not incur any fractures.

**Conclusion:** Most cranio-maxillofacial fractures seen at the emergency room were from motorcycle related injuries (70%). Despite implementation of Republic Act 10054 (The Motorcycle Helmet Act of 2009) majority of motorcycle-related accidents are still incurred by riders without helmets.

**Keywords:** *cranio-maxillofacial fractures, motorcycle accidents, helmet, tripod fracture, temporal bone fracture*

**Motorcycles** have become an increasingly popular form of transportation due to their low cost in fuel consumption and flexibility in avoiding traffic conditions in the metropolitan area. However, this type of transport is the top cause of fatal and nonfatal injuries in vehicular accidents.<sup>1</sup>

Several studies have shown that the use of helmets decreased the incidence of fatal and nonfatal injuries.<sup>2-5</sup> The enactment of the universal helmet law also decreased hospital admissions for motorcycle related injuries.<sup>2-5</sup> In the Philippines, the Motorcycle Helmet Act was signed into

law in March 2010.<sup>6</sup> Despite the enactment of this law there have still been numerous cases of motorcycle related accidents without helmet use.<sup>7</sup> As such there is a need to collect epidemiological data on the frequency of helmet use among motorcyclists. Determining the number of motorcycle accidents, demographics, frequency of helmet use and type of injuries may assist in formulating a program to increase awareness of the law and its provisions, and lessen injuries from road accidents.

The aim of this study was to determine the following: 1) frequency of helmet use in drivers or riders involved in motorcycle accidents; 2) the number of motorcycle-related cranio-maxillofacial injuries; 3) type of cranio-maxillofacial fracture incurred by patients who were helmet users versus non-users; and 4) mechanisms of injury.

**METHODS**

With institutional ethical review board approval, a retrospective cross sectional chart review of cases involving vehicular accidents between January 1 and December 31, 2013 was conducted. Charts were retrieved from the hospital medical records section using the patient’s case number and name obtained from the emergency room census.

Included were records of those 1) referred to the otorhinolaryngology Emergency Room (ORL ER) service from January 2013 to December 2013; 2) who were drivers and passengers involved in motorcycle accidents; and 3) who underwent radiographic tests. Excluded were records of patients 1) who absconded or went home against advice before they underwent radiographic tests; 2) who were involved in other types of vehicular accidents; and 3) involved in motorcycle accidents but not referred to the ORL service. A data abstraction sheet was used to encode data from the charts.

Data regarding qualitative variables were summarized using frequencies and percentages. Quantitative data were summarized using mean, standard deviation and these were analyzed using Microsoft Excel 2010 Version 14.0.7015.1000 SP2 (Microsoft Corp., Redmond, WA, USA).

**RESULTS**

Of the 121 charts of patients incurring cranio-maxillofacial injuries initially retrieved from the medical records section, 109 charts of patients meeting inclusion and exclusion criteria were involved in vehicular accidents. Seventy-six (70%) of these were motorcycle related. There were 69 males and 7 females, with ages ranging 14-60 years old. Demographic data of the patients are summarized in *Table 1*.

Only 29% of the patients in the charts reviewed wore a helmet during the time of the accident. Most of the patients who did not wear

helmets were between the ages of 18-30 years old and those that did wear helmets were mostly between the ages of 31-50 years old. Males and females showed the same trend of helmet use.

Cranio-maxillofacial fractures were noted for all the charts reviewed. Most patients had multiple fracture sites resulting in 102 fractures documented for the 76 patients. Seventy-five (75) fracture sites were noted for 54 patients not wearing helmets. Approximately 1.22 fractures

**Table 1.** Distribution of age according to sex of patients involved in motorcycle accidents (n=76)

	Frequency	Mean age +/- Standard Deviation	Range
Males	69	30 +/- 11 years old	14-60 years old
Females	7	29 +/-11 years old	17-47 years old
<b>TOTAL</b>	76	30 +/- 11 years old	14-60 years old

**Table 2.** Distribution of Mechanism of injury (n=76)

Type	Frequency	Percent
Motorcycle vs pavement	39	51.32
Motorcycle vs post	5	6.58
Motorcycle vs tricycle	4	5.26
Motorcycle vs bus	3	3.95
Motorcycle vs truck	3	3.95
Motorcycle vs motorcycle	3	3.95
Motorcycle vs gutter	2	2.63
Motorcycle vs car	2	2.63
Motorcycle vs jeep	2	2.63
Unknown mechanism	1	1.32
Motorcycle vs building	1	1.32
Motorcycle vs canal	1	1.32
Motorcycle vs wire	1	1.32
Motorcycle vs pedestrian	1	1.32
Motorcycle vs wall	1	1.32
Motorcycle vs truck	1	1.32
Motorcycle vs van	1	1.32
Motorcycle vs taxi	1	1.32
Motorcycle vs plant box	1	1.32
Motorcycle vs dog	1	1.32
Motorcycle vs tree	1	1.32
Motorcycle vs rock	1	1.32
<b>TOTAL</b>	76	100.00



per patient with helmets were observed while 1.37 fractures per patient were sustained by those who did not wear helmets. Only 1 out of the 54 patients without helmets had no fractures.

The most common fractures incurred by patients with and without helmets are described in *Figures 1 and 2*.

There were several mechanisms of injury noted for the charts reviewed. Motorcycle riders hit the pavement causing cranio-maxillofacial fractures more than 50% of the time. (*Table 2*)

**DISCUSSION**

Our study showed that 70% of vehicle related accidents are due to motorcycle use and the frequency of helmet use was low. Tripod and temporal bone fractures were commonly seen for patients in motorcycle

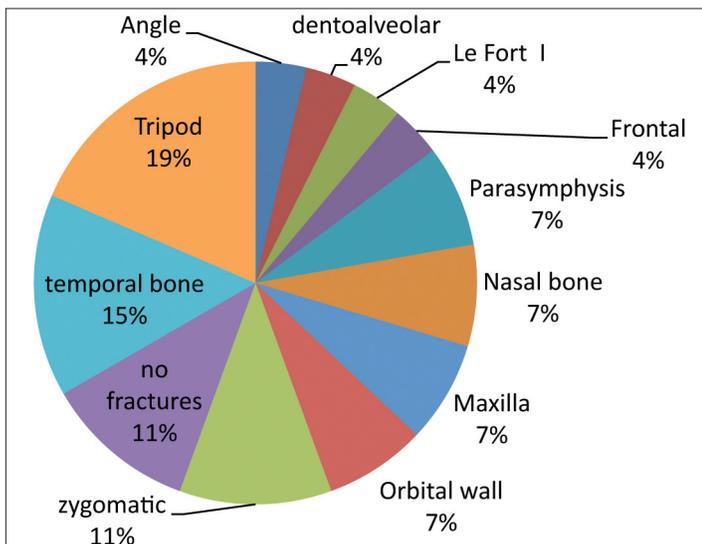


Figure 1. Most common fractures of patients with helmets during motorcycle accidents (n=27)

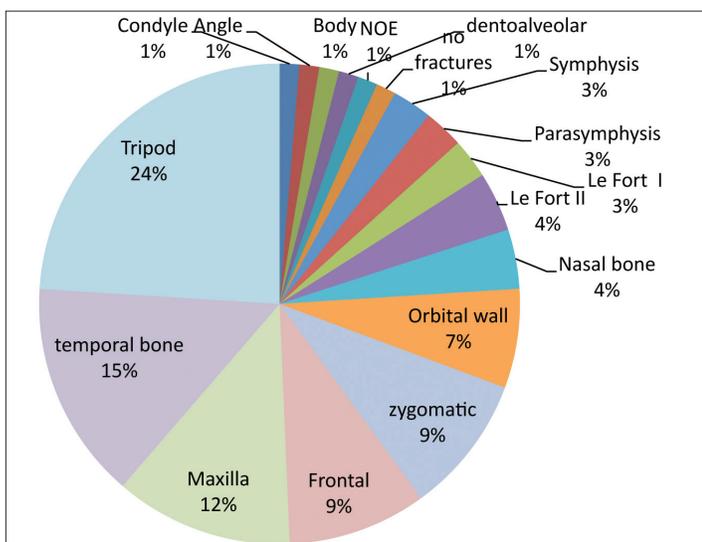


Figure 2. Most common fractures of patients without helmets during motorcycle accidents. (n=75)

accidents regardless of helmet use however more cranio-maxillofacial fractures were seen for patients not wearing helmets. Motorcycle users most commonly hit the pavement, which caused their injuries.

In other developed countries such as Italy there was decrease in hospital admissions for traumatic brain injuries after stricter implementation of the motorcycle helmet law.<sup>5</sup> A meta-analysis in the United States showed that a universal helmet act does decrease the number of hospital admissions.<sup>8</sup>

The data from our study showed that less than 25% used helmets during the time of the accident which is well below the values of other developing countries with a universal helmet law. In a similar study in Brazil, 76% of patients wore helmets during the time of the accident.<sup>4</sup> Our values were much closer to a study in Jamaica where only 34% wore helmets.<sup>3</sup> Even though these three countries had a universal helmet law, its effectiveness was not the same.

For this study, motorcycle accidents with or without helmets were more common in 30-year-old males (30 +/- 11 years old) and 29-year-old females (29 +/- 11 years old). This data is comparable to similar studies in developing countries such as Brazil and Jamaica, except for a younger peak age incidence of 10 to 19 years among female motorcyclists in the former.<sup>3,4</sup>

Motorcycle riders were at a disadvantage when collision occurred due to the lack of safety devices like seat belts and air bags. A helmet was the most important safety gear. A prospective cross-sectional study in a trauma center in Jamaica showed a 70% reduction in injury severity and 40% reduction in mortality of helmet users as compared to non-helmet users.<sup>3</sup> A Cochrane review of 53 observational studies concluded that motorcycle helmets reduce the risk of mortality with an Odds Ratio (OR) of 0.58, 95% Confidence Interval (CI) 0.50 to 0.68 among the 4 cross-sectional studies provided. The same review also found that helmets decrease the risk of head injury with an OR of 0.23 to 0.35.<sup>9</sup>

Although insufficient to generate a hypothesis on the impact of helmets on head injuries, our data suggests that when a ratio of the number of fractures per patient is obtained, more fractures were seen per person for the non-helmet group compared to the helmet group. The data also suggests that there were more instances where no fractures were seen for the group who used helmets compared to those who did not use helmets. Although our results were not concurred with by the Brazil study, where more fractures were seen for the groups who wore helmets, this may be because those that did not wear helmets in that study sustained encephalic trauma and treatment for the facial fractures were not prioritized.<sup>4</sup>

Helmets may not always protect riders from facial fractures but have been proven to prevent significant traumatic brain injuries.<sup>3</sup> In the study in Jamaica, those who did not wear helmets had more intracranial lesions (44.7%) and had more severe traumatic brain injuries (46.8%).<sup>7</sup>



The previously cited study in Brazil noted that mandibular fractures and fractures of the midface were common.<sup>4</sup> They associated it with the fact that even with helmets there is still a prominence of the mandible and dissipation of forces to the midface.<sup>4</sup> In contrast, the most common fractures seen for both helmet and non-helmet users in our study were tripod fractures followed by temporal bone fractures. Mandibular fractures were not as common. Temporal bone fractures were also noted in our study but not mentioned in the Brazil study,<sup>4</sup> perhaps because they did not consider these part of maxillofacial injuries. Temporal bone fractures were common in both helmet and nonhelmet groups in our study may suggest that helmets do not offer significant protection from this type of fracture.

The study had several limitations. The charts reviewed were limited to those referred to the ORL service at a tertiary hospital in the Philippines from January 2013-December 2013. Records of persons with motorcycle-related injuries that were not referred to our service were not included. Charts not retrieved by the records section were also excluded from data analysis. Radiographic images were not reviewed for confirmation of injuries listed in the charts. The study did not also account for those patients with fatal injuries or those who had traumatic brain injuries that could have been a significant addition to the data

gathered.

It is recommended that a prospective study will yield a more valid estimate of the cases referred to our service since we will no longer be dependent on the medical records being complete. It may also be important to note the frequency of use of Department of Trade and Industry (DTI) - approved helmets specifically and to determine the efficacy of these helmets in preventing head injuries. It will also be interesting to determine the efficacy of the different types of helmets in preventing certain facial fractures.

Traffic road accidents are a major public health problem because of the consequences of injuries to riders and destruction of property. Thus, several countries have already passed laws to prevent this, one of which is the universal helmet law. However, compliance to this law has still been low. As evidenced by our study, motorcycle related accidents continue to be a common reason for hospital admission. Most cranio-maxillofacial injuries are incurred by those who did not use helmets during the time of the accident. Data from this study can be used for further public health researches to improve health policies on road traffic accident prevention. There is still room for improvement in the implementation of the Motorcycle Helmet Act of 2009.

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