

Injuries and New Countermeasures in Motorcycle Racing in France.

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I. INTRODUCTION

While track environment is more controlled than on the roads, the speeds, aggressive riding, and tight competition in motorcycle racing still pose significant risks. In this context, serious injuries and fatalities are rare, but additional countermeasures are constantly required to improve the safety of the riders [1-3]. The introduction of new personal protective equipment (PPE), such as wearable airbags (inflatable bags integrated into clothing like racing suits or complementary vests), could be a solution to attenuate trauma. Most of the airbag devices protect the chest and the back. Some products provide coverage of other areas such as shoulders, ribs, abdomen or neck. These relatively recent safety devices have been mandatory in MotoGP World Championship since 2018, leading to a significant reduction of clavicle fractures [4]. The FFM (Motorcycle French Federation) has made the airbag compulsory in most of the French motorcycle racing competitions since 2024 and continues reinforcing safety by implementing the requirement of the chest protector for the 2025 season. Until now, mandatory PPEs were helmets, leather suits, gloves, boots and back protectors. The improvement of rider safety as well as the evaluation of new countermeasures requires the collection of dedicated data. This research aims to create a crash report database to obtain information of motorcycle racing accidents, injuries, as well as the use of PPEs.

II. METHODS

A dedicated survey of motorcycle racing accidents was conducted by the medical services of Le Mans circuit (France) during the 2024 season. The data collection focused on riders transferred to the medical centre of the circuit during FIM (International Motorcycle Federation) and FFM competitions, excluding sidecars classes (i.e., competitions involving three-wheeled racing vehicles powered by a motorcycle engine and controlled by two people). A specific questionnaire was created to gather information about the rider (gender and age), the accident situation (date, time, configuration, if the rider impacted an obstacle, and rider evacuation), the use of PPEs and injury assessment. Four main accident types were considered: high-side, low-side, low-side with tumbling and collision [3]. In terms of PPEs, the use of airbags (including activation) and chest protectors was asked. If technical problems, preventing airbag triggering or inflation, were noticed, it was considered that the rider was not wearing an airbag. Injuries described by medical services were grouped in five anatomical regions: head (including face), neck (including cervical spine), torso (thorax, abdomen, thoracic spine and lumbar spine), upper extremities (including shoulders) and lower extremities (including pelvis).

III. INITIAL FINDINGS

A total of 373 accidents were identified during FIM and FFM competitions in Le Mans circuit in 2024. Among them, 50 individuals transferred to the medical centre were eligible for this study (Table I). Most of the riders were men (94%), aged between 21 and 40 years old (68%), while the two women were less than 21 years old. Regarding accident configuration, 56% were high-sides, 24% low-sides (2/3 with tumbling) and 10% collisions. Only 20% of the riders impacted an obstacle such as a tire barrier or another bike. Ambulance (66%) was the most common means of evacuation. Most of the riders (78%) wore an airbag, while the use of a chest protector was lower (44%). The airbags were activated in 95% of the accidents. The 39 injured riders (78%) sustained a total of 58 injuries (Fig. 1). The upper extremities were the most frequently injured body region (38%), followed by the lower limbs (33%) and the head (16%). Neck injuries represented 9% of all injuries, while only 5% were noticed on the torso. Among upper limbs injuries, six riders had a shoulder injury, including three collarbone fractures, one dislocation, one sprain and one scapula pain. The accidents causing shoulder injuries were high-side (33%), low-side (33%), low-side with tumbling (17%) and collision (17%). Regarding the use of PPEs, two of the three riders with torso injuries wore an airbag that was activated during the accident. In the three cases, minor injuries, such as contusions or pains, were observed on the back or on the spine. All of them happened in high-side falls and two of the riders wore a chest protector.

TABLE I
CHARACTERISTICS OF THE POPULATION INCLUDED IN THE STUDY, 2024, FRANCE.

Variable	Answer	Number (%)	Variable	Answer	Number (%)
Gender	Male	47 (94%)	Fixed obstacle	Yes	10 (20%)
	Female	2 (4%)		No	40 (80%)
	NA	1 (2%)		NA	0 (0%)
Age	<15	2 (4%)	Evacuation	Ambulance	33 (66%)
	15-20	4 (8%)		Own means	16 (32%)
	21-30	16 (32%)		NA	1 (2%)
	31-40	18 (36%)	Airbag	Yes	39 (78%)
	41-50	3 (6%)		No	11 (22%)
	>50	6 (12%)		NA	0 (0%)
	NA	1 (2%)	Airbag activation	Yes	37 (95%)
Accident type	High-side	28 (56%)		No	2 (5%)
	Low-side	4 (8%)	Chest protector	Yes	22 (44%)
	Low-side + tumbling	8 (16%)		No	28 (56%)
	Collision	5 (10%)	Injury	Yes	39 (78%)
	NA	5 (10%)		No	11 (22%)

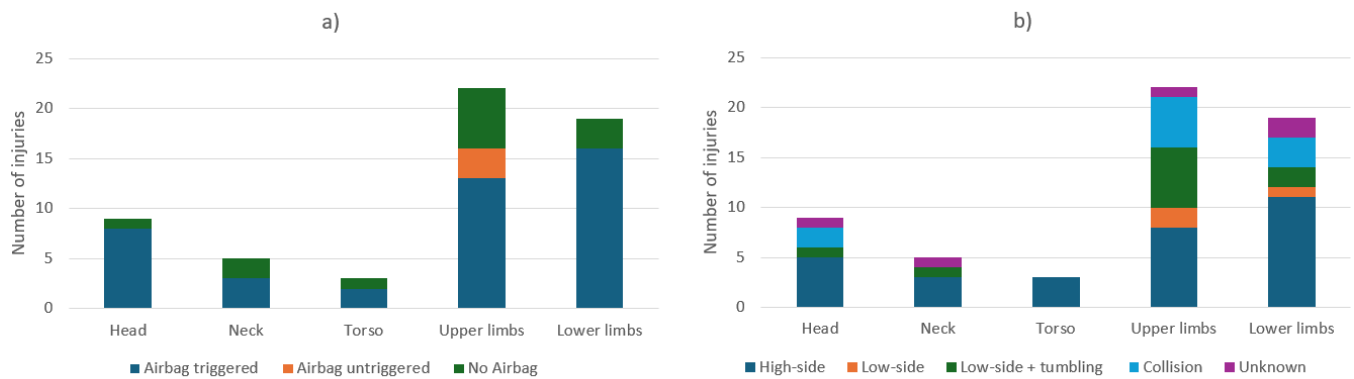


Fig. 1. (a) Distribution of injuries by airbag use and activation, (b) Distribution of injuries by accident scenario.

IV. DISCUSSION

Motorcycle racing accident data was collected by the medical services of Le Mans circuit in 2024. The limbs were the most frequently injured body regions. Contrary to road accidents [5], the upper limbs were more affected than the lower limbs, which is consistent with previous studies [1–3]. This could be explained by the difference in accident scenarios and environment. High-side falls were the most severe accident configuration on the track as in [3], while collisions against other vehicles or fixed obstacles, where normal impact speeds are predominant, represent the highest risks on the roads [5–6]. The use of airbags and chest protectors seems to improve the protection of the torso as it was the less injured anatomical region and only minor injuries on the back were observed. Detailed video and airbag data analysis as done by [7], to better understand accident chronology, body impacts and airbag proper operation, could be a perspective for this work. It was considered that all airbags were triggered before rider impacts and were equivalent in terms of protective areas, which was one of the main limitations of this work. Identify airbag brand and model would be useful for future effectiveness evaluation.

V. REFERENCES

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