

## Original Article

# Air Turbulence Associated with Crew Member and Passenger Injuries on Commercial Aviation

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### Abstract

**OBJECTIVES:** The incidence of injuries caused by air turbulences on commercial aviation in Thailand does not happen very often, therefore studies on the matter are quite rare. This research study aimed to investigate the types of organ injuries sustained in passengers, caused by air turbulence injuries, with a view to recommending appropriate preventive measures.

**MATERIAL AND METHODS:** The study is a descriptive retrospective study of demographic data from injured passengers at Samitivej Srinakarin Hospital. Data collection began from August 1<sup>st</sup>, 2018 and collected data dated from August 2015 to January 2020. A general analysis was made on the injury, treatment and patient length of stay, and subsequently reported in percentage format. Further analysis was performed for special injury cases.

**RESULT:** A total of 43 patients from 8 flights was included in the study. There were 45 episodes of injuries at Samitivej Srinakarin Hospital, with 78% of these being passengers, and 76% of the patients were international passengers. 64% of patients had multiple injuries in all of the episodes. Most injuries were located on the extremities (77%), with 60% of them located on the upper extremities. The second most frequent injury was head injury (47%) and most of the head injury patients were given conservative treatment by neurological sign observation in the hospital or at home. There was no complaint of abdominal injury. From 43 patients, 68% received conservative treatments, 24% underwent operations and 8% underwent general procedures. Total admission was 53% with an average length of stay (LOS) of 7.63 days.

**CONCLUSION:** Airplane injury cases can suffer from many types of organ injury or multiple organ injuries depending upon their activities during the time the air turbulence incurred. Cabin crew may have a higher risk of injuries than passengers.

**Keywords:** air turbulence injury, injury on commercial aviation, crew and passengers injuries.

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The study of injuries caused by air turbulence on commercial aviation in Thailand is quite rare because injuries do not happen very often. From foreign studies, injuries of passengers and crew members caused by air turbulence were mostly located on the lower extremities, especially the ankle<sup>1,2</sup> and was frequently found in passengers who did not fasten safety belts. This research study aimed to investigate the types of injury, treatment and the length of a hospital stay of passengers who were taken to Samitivej Srinakarin Hospital after their commercial flights had landed at Suvarnabhumi International Airport with a view to recommending appropriate preventive measures in the future.

### Materials and Methods

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The research study is a descriptive retrospective study of demographic data from injured passengers or crew at Samitivej Srinakarin Hospital, starting the collection from August 1<sup>st</sup>, 2018 and collected data was between August 2015 to January 2020. Data was collected on the air turbulence dates, total number of injured patients, number of patients who were hospitalized and types of injured persons.

**Inclusion Criteria:** All persons sustaining injuries caused by air turbulence on commercial airlines who were referred from Suvarnabhumi International Airport to Samitivej Srinakarin Hospital. The following data included:

1. General information of injured patients for example age, gender and nationality
2. Types of injured organs
3. Treatment categorized by conservative treatment, surgery in the operating room and some general procedures such as wound dressing, casting or intercostal drainage (ICD)
4. Length of hospital stay (LOS) and Injury Severity Score (ISS) only for admission cases

**Exclusion Criteria:** People with injuries unrelated to air turbulence, injured persons who had unclear history from air turbulence and death, persons at the scene of an airplane crash.

**Table 1:** Summary of Flight Events

Flight	Episodes	Admit	Multiple Injuries	Passenger	Crew
May 1 <sup>st</sup> 2017	29	17	18	29	-
Nov 23 <sup>rd</sup> 2018	3	3	3	1	2
Dec 8 <sup>th</sup> 2018	6	3	5	4	2
Dec 13 <sup>th</sup> 2018	1	-	-	-	1
Jan 10 <sup>th</sup> 2019	1	-	-	-	1
Apr 22 <sup>nd</sup> 2019	1	-	-	-	1
May 12 <sup>th</sup> 2019	3	-	3	-	3
Sep 15 <sup>th</sup> 2019	1	1	-	1	-
<b>Total</b>	<b>45</b>	<b>24</b>	<b>29</b>	<b>35</b>	<b>10</b>

From the data collected, Table 2 shows that 78% of all patients were passengers, with 76% of these being international passengers. Of the 43 patients, 68% received conservative treatments, 24% underwent operations and 8% underwent general procedures. The admission was 24 from 45 episode (53%) the average LOS was 7.63 days and the average Injury Severity Score (ISS) was 6.79.

The longest length of stay (37 days) was a 68 years old male patient diagnosed with fracture of left femur, pelvis, multiple left ribs with hemothorax and open wound at left ear pinna. He underwent an open reduction internal fixation (ORIF) at left femur, sutured left ear pinna and received left intercostal drainage (ICD). He underwent a rehabilitation program and stayed until his condition improved and he returned to his home country assisted by a medical escort team. This patient has the highest ISS = 20.

The lowest ISS = 0 was a female patient aged 34 years who suffered from a contusion at left shoulder, breast and pelvis. She was diagnosed with incomplete non-displace fracture of left anterior acetabulum. She was hospitalized for 3 days and received only pain killer medications.

Among all the injured passengers, there were 5 children with an average age of 1.7 years. The youngest (6 months old)

**Study Design:** The research study is a descriptive retrospective study of demographic data. Results were reported with percentage and mean.

## Results

Data was collected between August 2016 to January 2020 with a total of 43 injured persons from 8 flights with 45 episodes of injuries, see Table 1. From a total of 43 injured persons, there were 45 injury episodes as one of the cabin crew members sustained 3 airplane-related injuries in 5 months. He had a contusion at his right arm on December 13<sup>th</sup>, 2018, another contusion at the right wrist on January 10<sup>th</sup>, 2019 and a low back injury from a trolley cart collision on April 22<sup>nd</sup> 2019.

**Table 2:** Demographic data (n = 45)

Health information	n (%)
Average age (years)	33.93
Sex	
Male	20 (44)
Female	25 (46)
Race	
Thai	11 (24)
Foreigner	34 (76)
Status	
Passenger	35 (78)
Crew	10 (22)
Treatment	
Non operation	30 (68)
Operation	11 (24)
Intervention	4 (8)
Length of Stay of 24 admission	
< 3 days	10 (42)
4-7 days	6 (25)
7-14 days	5 (21)
> 14 days	3 (12)
Average (Days)	7.63
ISS of admission cases	
Maximum	20
Minimum	0
Average	6.79

only had a minor contusion on his face. He was given neurological signs observation outside the hospital without any medication.

The oldest patient was a 69-year-old male who had multiple injuries at the head, cervical spine and the eye. He experienced weakness at the upper and lower limbs, the ISS = 9. He was given medications, underwent a rehabilitation program and stayed in the hospital for 29 days.

64% of patients had multiple injuries. Most of the injuries were located on the extremities (77%), with 60% of them located on the upper extremities. The second most common injury was head injuries (47%). Most of the head injury patients were given conservative treatment and neurological signs observation in the hospital or at home. Among the injured patients, there was a female passenger aged 26 years who was diagnosed with vaginal wall tear because she was in the toilet during air turbulence incurred. She underwent vagina repair in the operating room, and stayed for one night in the hospital for bleeding observation. There was no complaint of abdominal pain or injury from any passengers or crews.

## Discussion

From this air turbulence study, the most commonly found injury was extremities injuries, mainly on the upper extremities. This was different from other studies as injuries of lower extremities, mainly at legs and ankles, were found to be more common than upper extremities.<sup>1,2</sup> The patients with upper extremity injuries were given conservative treatments.

It was seen that none of these patients had made any complaint of abdominal injuries, which may imply that fastened seat belts during the time of the air turbulence may protect the patients from abdominal injuries, although extremities injuries are much more common. In the case where the passenger was either outside their seat or did not fasten their seat belts, it is also possible that because the abdomen is located at the midline of the human body, the extremities or the head is more at risk of air turbulence injuries.

This may be different from traffic injuries, where in Bangkok a previous data showed that 7% of death from traffic injuries was caused by abdominal injuries<sup>3</sup> or because the diagnosis of abdominal injuries was more difficult than other organ injuries, so it is rarely found.

Crew members experience air turbulence more frequently than normal passengers, and are therefore more susceptible to injuries. The most common injuries were at the upper extremities and back as another has shown.<sup>4</sup>

More research studies are needed to assess the efficacy of the use of a preventive brace position during air turbulence, especially during clear air turbulence which is unpredictable.<sup>5</sup> The safest position for the passengers to avoid air turbulence injuries should be communicated to them, such as bending

**Table 3:** Types of Injuries (n = 45)

Organ injury	n (%)
Multiorgan injuries	29 (64)
Head injuries	21 (47)
Face	8 (18)
Eye and periorbital area	4 (9)
Neck	5 (11)
C-spine	3 (7)
Chest	6 (13)
Back	7 (16)
LS-spine	3 (7)
Pelvis and hip	6 (13)
Perineum	1 (2)
Extremities	35 (77)
Upper	21 (60)
Lower	14 (40)

down, rolling the body like a ball by covering the face with the arms, covering the head with two hands or other safety positions. Safety training for preventive positions should be provided for the crew members such as the brace position.<sup>6</sup> This position is where the individual bends down from the sitting position, to be used before the airplane crashes or falls on to water surface.

Limitations to this study was the small number of injured persons, and there was no record of some severely injured passengers and minor injury passengers who did not visit the hospital, and recent data was not able to be obtained as the COVID-19 pandemic in early 2020 had caused airline businesses to be temporarily in shutdown.

Furthermore, the airport first aid service team and related public health services did not have sufficient reports of injured passengers from previous air turbulence incidents. If sufficient data storage is available for air turbulence-related injuries, it could allow for further in-depth analysis for the creation and adoption of more effective air turbulence preventive measures, and it may significantly help to reduce the cost of treatment in the future.

## Conclusions

Airplane injury cases caused by air turbulence can result in many types of organs injury or multiple-organ injuries depending upon the passengers activities during the incident. Most of the injuries occurred at the extremities. Cabin crew, especially steward or air hostess, may have higher risk of injuries than passengers.

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