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## Correlation of Trauma and Cause of Death to Accident Reconstruction: A Case of a Flight Accident Report

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**REFERENCE:** Min, J.-X. and Jia, M.-Z., "Correlation of Trauma and Cause of Death to Accident Reconstruction: A Case of a Flight Accident Report," *Journal of Forensic Sciences*, JFSCA, Vol. 37, No. 2, March 1992, pp. 585-589.

**ABSTRACT:** This paper reports on the disaster that occurred after a flight was hijacked at Baiyuen International Airport in Guangzhou, China, on Tuesday, 2 Oct. 1990. The authors show the results of analyses for the causes of death and trauma and compare the disaster with several previous flight accidents that have occurred in China. The authors show, with the analysis on this accident, the possibility and reliability of reconstructing a disaster by medicolegal investigation.

**KEYWORDS:** pathology and biology, aircraft, accidents, accident reconstruction, human identification

Disasters are characterized by a significant loss of human life. Among many kinds of disasters, the death rate is the highest in aircraft accidents [1,2]. The first aircraft accident was reported in 1908 [3]; since then the frequency of accidents and the number of victims have increased. Therefore, prudent investigation of aircraft disasters demands thorough forensic medical investigation, including an autopsy of each victim and determination of the precise cause of death for all fatalities [4]. The three reasons for performing autopsies of victims, cited by Cullen and Turk [5], are to address medicolegal problems, to evaluate safety equipment, and to reconstruct events surrounding the accident.

### Description of the Accident

On the morning of 2 Oct. 1990, China Airline Flight B-2510, a Boeing 737 carrying 9 crew members and 93 passengers, was hijacked in flight en route from Xiamen to Guangzhou, China. One hour later, the pilot tried to perform an emergency landing at Baiyuen International Airport in Guangzhou, but the plane left the runway after having run 300 m and rushed toward the apron. In the apron, Flight 2510 struck both Flight B-2402, a Boeing 707 (with no one in it), and Flight B-2812, a Boeing 757 which carried 118 passengers and was ready to take off, while taking off again. Finally, severely damaged, Flight 2510 plummeted to a grassy separate area of the airport and broke apart.

### Victims

A total number of 128 fatalities and 52 persons severely injured resulted from this accident involving the two planes, Flights B-2510 and B-2812. Among the fatalities, 82

Received for publication 4 Feb. 1991; revised manuscript received 18 July 1991; accepted for publication 23 July 1991.

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victims came from Flight B-2510 and 46 from Flight B-2812. The sex ratio was 87 males to 41 females. The eldest victim was 70 years old and the youngest victim was only 6 years old. The distribution of nationalities of the fatalities was 121 Chinese, including 90 from the Mainland and 31 from Taiwan; 5 from Hongkong and Macao; 1 American; and 1 Briton. One hundred and twenty victims died at the moment of the accident and 8 died in the hospital after the accident. The longest survival time was 96 h after the disaster for 8 victims.

### Causes of Death and Trauma

Table 1 presents the classification of the causes of death in all the fatalities. It shows that mechanical injury was the cause of death for almost all of the victims on Flight B-2812. The victims from Flight B-2510, however, mostly died from fire, which included inhalation of superheated air and chemical gases.

Both the pilot and the hijacker died from fire in the cockpit of Flight B-2510.

The sites and the patterns of mechanical injury in the victims are shown in Table 2. The head injuries included fractures of the cranial vault, basilar skull fractures, craniofacial fractures, intracranial hemorrhages, and brain injuries. The results were similar to those in reports from many other authors [4,6-8].

The cause of the crash and the situation of the plane while the disaster was occurring correlate directly with the causes of death and trauma among the fatalities. The authors compared this case with four other cases in China, as shown in Table 3, and coinciding with them. Even in this case, clearly different results were observed for the two crashed flights because of differences of the situations of the two planes.

### Accident Reconstruction

Information obtained from medicolegal investigation of the aircraft accident and the initial seat diagrams of the passengers as they boarded the airliners has provided useful clues in reconstruction of the accident.

TABLE 1—Classification of cause of death in the fatalities.

Flight No.	Fatalities (n)	Mechanical Injury		Injury + fire + Inhalation		Fire + Inhalation	
		n	%	n	%	n	%
B-2812	46	45	97.8	1	2.2	0	0
B-2510	82	14	17.1	14	17.1	54	65.8

TABLE 2—Distribution of injuries in the fatalities.

Injuries	B-2812		B-2510	
	n	%	n	%
Head injuries	38	82.6	14	17.1
Decapitation	8	17.4	2	2.4
Fracture of bones of the trunk	11	23.9	9	10.9
Fracture of upper limbs	10	21.3	6	7.3
Fracture of lower limbs	11	23.9	10	12.2
Multiple injuries <sup>a</sup>	30	65.2	13	15.8

<sup>a</sup>Including at least one kind of fracture in addition to head injury.

TABLE 3—Situations and causes of five aircraft accidents in China.

Year	Site of Crash	Flight No.	Situation and Cause of the Crash	Fatalities, No.	Main Cause of Death
1982	Gueling	B-266	impact with a mountain and the plane broke apart	112	falling injury
1983	Guangzhou	B-202	burning and emergency landing	25	fire or inhalation of superheated air or chemical gases
1985	Jinan	B-434	impact with the ground when the plane was landing	38	crash injury
1988	Zhongqin	B-222	impact with an obstruction in flight	108	crash and falling injury
1990	Guangzhou	B-2510 B-2812	impact with a parked plane while attempting an emergency landing and take off	82 46	fire or inhalation, crash injury

As summarized in Figs. 1 and 2, there were 45 victims who died from head injuries in Flight B-2812, which was parked at the apron; these victims were seated in seats No. 16 through 25. Through postmortem examination it was established not only that the injuries of the passengers on the left side of the plane were more serious, but also that there were more multiple injuries in the passengers on that side. At this point, we may undoubtedly conclude that the left side at seats No. 16 through 25 was the site of impact. For the Flight B-2510, the majority of the victims were seated in seats No. 3 through 18. The results of investigation present some quite significant phenomena: the passengers who had seats No. 3 through 6 mostly died from head injuries; those in seats No. 7 through 10 commonly survived; and the passengers who died from fire or gas inhalation were usually concentrated in seats No. 11 through 18. These findings strongly suggest that (1) while crashing into Flight B-2812, Flight B-2510 still maintained a high speed (approximately 200 km/h) and a large deceleration force, which caused the passengers seated in front of the fuselage to receive severe head injuries; (2) after the initial impact or before plummeting to the ground, Flight B-2510 had broken apart in the middle of the fuselage so that the passengers in seats No. 7 through 10 would have been thrown out the plane through the broken "hole" if not secured by their seat belts; and (3) the plane's further breakup in plummeting to the ground may have obstructed the broken hole so that the passengers seated at the tail section of Flight B-2510 could not get out and died from fire and inhalation of superheated air and chemical gases.

In fact, according to reports of witnesses and the results of investigations of the accident, the hijacker may have attacked or interrupted the pilot when Flight B-2510 was landing at the airport so that the plane left the runway. The pilot then had to lift off once again to avoid crashing into Flight B-2812 after his plane had hit Flight B-2402. But the distance between Flights B-2510 and B-2812 was too short for Flight 2812 to escape impact. The undercarriage of Flight B-2510 crashed into the middle of the fuselage of Flight B-2812.

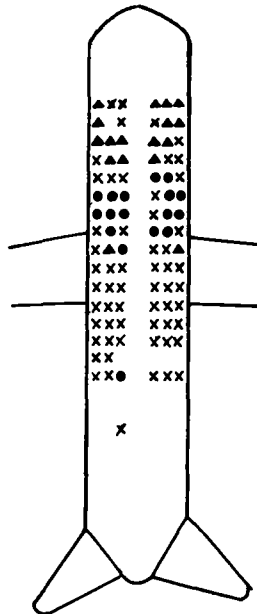


FIG. 1—Diagram of the passengers' initial seats in Flight B-2510: ●, survived; ▲, died from head injuries; ×, died from fire or inhalation of superheated air or chemical gases.

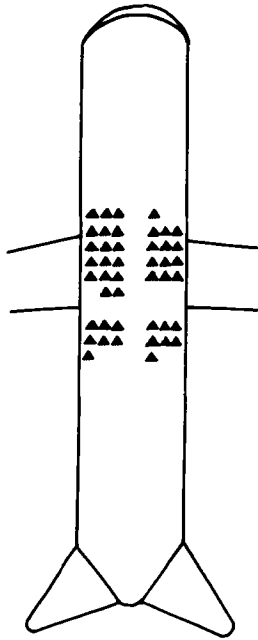


FIG. 2—Diagram of the passengers' initial seats in Flight B-2812: ▲, died from head injuries.

At once, Flight B-2510, which was severely damaged as a result of the two crashes, plummeted to the ground.

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