

EPISODE OF UNCONSCIOUSNESS IN A JET FIGHTER PILOT—A CASE REPORT

By

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Introduction

Momentary lapse in consciousness in a pilot of a jet aircraft could be the cause of a major flying accident. For this reason any history suggestive of this condition merits serious consideration and thorough investigation. In most of these cases it is difficult to establish the exact cause of impairment of consciousness due to lack of available clinical evidence even after detailed investigations. In 88 cases of unconsciousness among aircrew evaluated at the School of Aerospace Medicine (U.S.A.F.) during the years 1966-67, no abnormality was detected in over 70% of cases.¹

A young pilot who was alleged to have lost consciousness in the air, was investigated at the Institute of Aviation Medicine, I.A.F. Results of the laboratory investigations were correlated with the flight profile and the sequence of events as it occurred in the air. Details of the case report are being presented in the paper.

History of the case

On 13th July 1968, a pilot aged about 25 years was authorised to fly as No. 2 in a jet fighter aircraft formation for a practice combat sortie. He was briefed to stay

with No. 1 (150 to 200 yards behind), to search and report.

The formation took off at 1346 hrs. and climbed to an altitude of 25,000 ft. The pilot stated that he switched on oxygen from ground level. During the climb, the pressurisation warning came 'ON' at about 10,000 ft. indicating that the pressurisation was not adequate. He did not report this but continued with the climb since he knew that he was not going to remain at high altitude for long.

After attaining the desired altitude, the formation commenced descending turns. During these turns No. 2 found that, though he was with his leader, he was lagging behind all the time. The turns were executed with one notch of flap.

At about 20,000 ft., No. 1 put his aircraft in a shallow dive to build up speed. No. 2 followed him. His speed at this stage was about 250 knots. By now No. 2 had fallen outside No. 1's turn path and was lagging about 400 to 500 yards behind. At this stage, in order to catch up with the leader, No. 2 tightened his turn. He did not remember whether he put flaps up or not. He stated that he 'blacked out' following the turn. No. 3 noticed that No. 2 was

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in a steep dive and the latter was not responding to the instructions on the R/T to pull up. The height of No. 3 at this time was between 21,000 and 20,000 ft. and he estimated the height of No. 2 to have been 18,000 and 17,000 ft.

However No. 2 stated that he heard No. 3 calling up on R/T asking him to pull out only at about 8,000 ft. No. 2 noted that his vision was blurred and his aircraft was in a steep dive.

He tried to move the stick with no response. The sight of fast approaching ground was frightening and he decided to eject. He reached for the face blind and pulled the overhead firing handle twice as one second built-in delay mechanism gave him the impression as if the seat was not going to fire. There was also evidence to suggest that the seat pan firing handle had been pulled. It was also established that both the manual 'D' rings had been pulled. The scissor shackle had opened but the drogue shroud line had snapped off at the drogue shackle. This is an indication that finding himself not separating from the seat, the pilot had detached himself from the seat and deployed his parachute by manually operating the two 'D' rings on the parachute harness.

He was conscious when he was picked up and was immediately hospitalised.

Details of Injuries Sustained

- (a) Spinal Compression Fractures of Dorsal Vertebrae 9, 11 and 12 and lumbar 1.
- (b) Fracture olecranon process left ulna.
- (c) Subconjunctival haemorrhage both eyes with oedema and bluish discoloration of upper and lower eyelids both eyes.

- (d) Small lacerated wounds right upper eyelid, bridge of nose and right cheek.
- (e) Sprain right ankle.

He was treated conservatively with immobilisation of the spine and left ulna. He was discharged on 19th October 1968 and sent on 8 weeks sick leave.

Results of General Examination at 1 A.M.

General condition—Satisfactory.

Cardiovascular system—Nothing abnormal detected.

Central nervous system—No abnormality detected.

Eyes—No abnormality.

ENT—No abnormality.

Spine—No deformity or muscle spasm detected. Range of movements was full. The subject could raise both legs separately upto 90° in lying down posture. He had no neurological deficit.

Psychiatric examination—No personality defects or maladjustment.

All other systems—Clinically normal.

Results of Special Investigations

Blood—Routine haematological examination showed no abnormality.

Glucose Tolerance Test—Normal.

Urine—No abnormality detected.

Tilt Table studies—Response was normal.

E.C.G.—Carried out at rest and after exercise at ground level and under hypoxia. Revealed no abnormality. No change in the rhythm or conduction times was noted.

Vestibular Function Tests—Rotation and caloric tests were carried out and no vestibular imbalance was detected.

Decompression Chamber Test—The subject was taken to 25,000 ft. with 100%

oxygen. Oxygen was disconnected at 25,000 ft. and this altitude was maintained for one minute. Then the chamber was brought down to 20,000 ft. at 2,000 ft. mt. Altitude of 20,000 ft. was maintained for 5 minutes, the subject still being under hypoxia. He was made to perform simple tasks at this altitude under hypoxia. There was no decrement in his performance nor did he become unconscious. Oxygen was connected and he was brought down to ground level.

"G" TOLERANCE STUDIES

Human centrifuge run was carried out at about 1400 hrs. The subject had his breakfast at 1130 hrs. He was wearing Anti-g-suit.

1st Run: 0.5 g/sec. upto 4G—Peak for 15 secs.

2nd Run: 0.5 g/sec. upto 3g for 30 seconds followed by 1 g/sec. upto 6g for 5 seconds.

During both the runs his cardiovascular response were within normal limits. No blackout or unconsciousness were observed.

X'RAY SKULL—(AP AND LATERAL)

No fracture was detected. Skull vault was found to be normal in texture and density. Sella tursica, vascular and sutural markings were normal. No pathological calcification was seen.

X'RAY LEFT ELBOW (AP AND LATERAL)

Evidence of fracture olecranon could not be detected.

X'RAY SPINE

Shows anterior wedging of DV 9, DV 11, DV 12, and L.I. Consistent with compres-

sion fracture. There was evidence of disc herniation into the body of DV 12.

E.E.G.

Shows fast activity in the right temporal region.

E.E.G. RECORDING DURING HUMAN CENTRIFUGE RUN

Fast activity is seen in both the channels (F8-T4 and F7-T3) but it is more marked in frequency and amplitude on the right side, i.e., F8-T4 channel.

Discussion

This pilot was in a healthy state during take off and climb, and his performance upto the tight turn was normal. He did not take the pressurisation warning light seriously as he was keen not to abandon the sortie and he was only to be for a very short time at 25,000 ft. During combat he was lagging behind and went outside his leader's turn. He therefore dived, to increase his speed and executed a tight turn to place himself correctly with respect to the leader. His actions upto this were correct and there is no reason to suspect his faculties as below par.

During the turn, his throttle was full and as he was increasing his speed with a dive, his flaps were up. His left hand was on the flap lever. The flap lever in this aircraft is located on the side of the main instrument panel straight ahead. The lever is moved down for "flaps down". The officer stated that he was holding this lever with his outstretched hand for use of flaps when required in the turn. There exists a possibility of its inadvertant operation due to increased weight of the hand in a rapid G manouvre. That the flaps were in fact down has been confirmed by the Accident Investigating Team.

Flight trials conducted by the Court of Inquiry showed that when put in a shallow dive at 250 knots with full throttle, at 21,000 ft. with one notch of flap, this aircraft built up speed and the angle of dive increased. There was a distinct tendency to bunt and negative 'G' was experienced by the pilot of the aircraft carrying out the test trials. Beyond 400 knots, the rate of build up of speed, angle of dive and loss of height were extremely rapid. The height loss during the speed build up from 250 knots to 500 knots was about 9,000 ft. Recovery was not possible by harsh use of the controls.

It is therefore reasonable to assume that immediately following the turn, the pilot lost control of the aircraft. It picked up speed with an increasingly nose down attitude. It probably also went through a bunt, which may account for the subconjunctival haemorrhages noticed. When he became aware of his environment, finding the aircraft in a steep dive he tried to recover. Harsh use of the controls, as may be expected under these circumstances, did not effect a recovery. He, therefore, decided to eject. He estimated the height at this stage to have been around 8,000 ft. At a diving speed of 400 knots (average) the time taken for the aircraft to descend from about 18,000 ft. to about 8,000 ft. *i.e.*, the time that had elapsed from the moment he 'blacked out' till he became aware of his environment will be 10 secs. approximately.

Except for this short period of 'lack of awareness' of surroundings, all his actions subsequent to the dive attitude of the aircraft had been appropriate to the situation. He took all actions necessitated by the subsequent emergency, namely, non-separation of the seat. Thus we find his mental faculties functioning properly upto the tight turn and again after 10 seconds, he is in

control of his faculties. Psychological and environmental factors which could have caused the episode will now be considered.

HYPOXIA

The possibility of hypoxia is ruled out in view of the fact that this officer had 100% oxygen (ON) from ground level and no evidence to suggest undue susceptibility to hypoxia during the chamber run was found.

DECOMPRESSION SICKNESS

At no stage did the officer complain of symptoms of decompression sickness. Further the altitude at which he was operating was not likely to produce decompression sickness.

HYPERVENTILATION

The possibility that this officer could have been hyperventilating in the air due to his anxiety to catch up with the leader does exist. During the centrifuge runs and E.E.G. recordings he was made to hyperventilate in order to determine whether he is unduly sensitive to changes in the blood pH caused by hyperventilation. Results of these tests were negative in this case indicating thereby that hyperventilation *per se* could not have caused this episode.

HYPOGLYCAEMIA

This officer had a substantial breakfast 2½ to 3 hours prior to the flight. It is known that blood sugar levels can decrease to fasting levels by this time. However, glucose tolerance test indicates no abnormality of carbohydrate metabolism. It is therefore unlikely that hypoglycaemia by itself could have caused the episode.

ACCELERATIVE FORCES

During the sortie, the pilot was wearing an anti-g-suit and it is not possible to pull more than 5 to 6 G at 20,000 ft. at the speed he was flying. It is possible that the pilot pulled 5 to 6 G as he banked the aircraft to maximum. The G tolerance of the pilot as tested on the centrifuge was found to be normal. Nevertheless it is possible that the pilot's tolerance was diminished on that particular day. It is known that an individual's tolerance can vary from day to day by as much as 0.5 to 1.0 G. Thus 'G' forces could have played some role in causing cerebral anaemia and contributed to his 'loss of awareness' of surroundings.

DISORIENTATION

This officer had just returned from 45 days annual leave. Pilots are more susceptible to spatial disorientation when they return to flying after leave². During the star board turn he had to turn his head both to his left and right to look out for his leader as well as No. 3. Incidence of Coriolis vertigo playing a role in this situation is quite plausible. Coriolis reaction results from the movements of the head at right angles to the plane of an existing rotation of the body. It produces confusion and marked autonomic response. This might have given him the impression that he was not in command of his faculties. Melvill Jones¹, quotes the example of an experienced pilot, who in a similar situation, of the aircraft getting suddenly into an unusual attitude, left the controls in a state of disorientation.

Fortunately the aircraft sorted itself out and when control had been regained flew the aircraft to base.

EPILEPSY

In all such cases, epilepsy is always to be kept in mind. The E.E.G. findings are not

typical of epilepsy. However, the E.E.G. findings indicate a possible focal lesion in the right mid temporal region. With our present state of knowledge, it is difficult to predict the nature of the lesion, if any, and also to state whether this lesion could have caused the episode.

The E.E.G. findings could also have resulted from injuries sustained during ejection or during parachute fall on the ground. There was no evidence of fracture of the skull on X'ray. His Bone-dome has not been traced following its loss during exposure to the wind blast. Since he landed on uneven ground without bone-dome the possibility of the head striking on hard ground also exists.

COMBINED EFFECT OF MULTIPLE STRESSES

In a study by Powell *et al.*³ eighteen medically fit aircrew were exposed to combinations of voluntary hyperventilation, 3.4 G for 5 seconds on the centrifuge and lowered blood sugar level. A large proportion of the subjects was incapacitated by the effect of two or more of these combined stimuli although these same stimuli when acting separately had failed to induce comparable disturbances in cardiac or cerebral function.

A similar possibility of simultaneous exposure to stresses, *viz.*, accelerative forces, lowered blood sugar levels, hyperventilation, exists in the case under discussion.

His failure to remember the events following ejection are easily explainable when one considers the stress of the emergency, ejection in an unusual attitude, extensive spinal injuries sustained and "sensory swamping" due to effects of wind blast at nearly 450 to 500 knots of speed.

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