Unusual Ejection Injury : A Case Report

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One of the pilots of a jet fighter trainer aircraft developed a sub - diaphragmatic gas shadow with paralytic ileus a few hours after a low level ejection during which he suffered a severe compression fracture of his LI vertebra. The pupil pilot escaped with a mild compression fracture of his T12 vertebra. The injury to the 1st pilot has been discussed and the unusual presentation brought out.

EMERGENCY escape from aircraft may be brought about with or without assistance. Modernjet fighter aircraft are equipped with ejection seats which propel the pilot outwards so that the pilot safely "clears" the aircraft. However, a severe force is required to eject out the pilot and this force is transferable along the spine[2]. Therefore, ejection from an aircraft is often associated with compression fractures of the spine, especially around T 12 to L1 vertebrae[3]. Apart from spinal injury, flaying of arms and legs or fouling with aircraft structures may also lead to severe injury[5–6]. Injuries to hollow organs in the thorax and abdomen due to abrupt accelerations as met with during ejection and on emerging out of the cockpit (Q Forces) have also been reported, though uncommon[4]. This report deals with one such interesting case where perforation of one of the abdominal hollow organs was suspected to have occurred as a result of ejection.

Case History

Two pilots of a jet fighter trainer aircaft had to abandon their aeroplane due to an emergency. The ejection was carried out immediately on take off and was at a very low level (about 200 feet altitude) at an IAS of about 170 Knots/hr. Due to a split second decision made to abandon the aircraft, the crew did not have adequate time to take the proper ejection attitude. Both were recovered after a safe descent. There was no history of rough landing which might have caused or aggravated injuries.

Injuries to the Pilots

One of the pilots was asymptomatic on landing and walked about freely without any discomfort. However, a routine X-Ray of his spine on admission to hospital, revealed a minor compression fracture of his T 12 vertebra. He made an uneventful recovery.

The instructor pilot who ejected out after his pupil, had complained of moderately severe pain in the lower part of his back on landing. He was given an ampoule of tubonic morphia and was evacuated to the nearest Military Hospital. Clinical examination and X-Ray spine confirmed a severe compression fracture of the L1 vertebra (Fig. 1). The pedicles of this vertebra were also fractured (seen radiologically).

Within 4-5 hours of the injury, this pilot developed (1) pain in the back of both thighs (2) urinary retention and (3) gradually increasing painless gaseous distention of the abdomen with feeble bowel sounds. X-Ray abdomen revealed multiple gas shadows with a well demarcated gas shadow under the diaphragm (Fig. 2). The blood pressure was normal. He was promptly given conservative treatment with I.V. fluids, gastric suction and sedatives and put under observation. Urinary bladder was evacuated by catheterization. The following morning, gaseous distention which had initially reduced, reappeared again. The gas shadow under the diaphragm persisted on X-Ray (both pictures were taken in the sitting position). The urinary retention continued.

In view of the persistent and progressive gaseous distention of the abdomen and radiological finding of the persistent unexplained sub diaphragmatic gas shadow, an intra abdominalc atastrophe was feared and an emergency laparotomy was carried out the same morning. The operation, however, failed to reveal any perforated abdominal viscera or any other trauma inspite of minute scrutiny. The abdomen was closed in layers and the patient was again put on conservative treatment. The gas shadow diminished and disappeared in a few days. Also, his state of bowel and urinary retention subsided. Ten days after removal of sutures a spinal extension plaster jacket was given to stabilise the injured spine.

Discussion

The spinal injuries in both the pilots are explained by the fact the ejections were unplanned, and at very low level, and hence they did not have time to attain the stipulated ejection postures[2]. The pupil pilot's injury was of a mild nature. However, the instructor pilot had severe spinal injury. History revealed that the instructor's posture at the time of ejection was very badly aligned as he had to perform certain vital tasks prior to ejecting and did not have any time left to consider the ejection posture prior to abandoning the aircraft.

The signs of (a) urinary retention (b) pain in the back of the thighs, and (c) bowel distention and retention indicative of a paralytic ileus were attributable to a degree of spinal concussion due to injury in the region of S1 to S3 roots of the spinal cord. Spinal concussion as a result of injury to the spinal column is a well recognised clinical entity[3,5]. The presence of a well defined gas shadow under the diaphragm—a radiologically diagnostic feature of repture of a hollow abdominal organ, goes unexplained. The following discussion is offered.

Perforation of a gas containing hollow organ in the abdomen

The presence of a subdiaphragmatic gas shadow is usually indicative of a perforation of a gas containing hollow organ in the abdominal cavity. Injuries to abdominal and thoracic hollow organs have been reported as a result of exposure to abrupt vertical and transverse accelerations[4]. During ejection, abrupt +Gz applied to the diaphragm, stomach and filled intestinal loops, causes a downward stretching so that a certain amount of tensile stress is applied in the area of suspension of these organs. If this force exceeds the elasticity limits of the organ involved, damage to these organs may result[4]. Immediately on egressing from the cockpit, the body is subjected to severe transverse decelerations (Q Forces), which again, due to the above mentioned reasons, at speeds in excess of 400 knots per hour may lead to hollow organ damage[4]. Then again parachute opening shock and landing on the ground also produce shock waves which may cause internal injuries. In this case the pilot ejected at low level at an IAS of about 160-170 Knots. Hence the Q force applied here was of a nominal nature, not sufficient to cause rupture of hollow organs. At such a low altitude the parachute opening shock calculated to be[10] ^{2}g, was negligible. Also, his touch down speed would not have been more than about 17 feet/sec with the 24 feet diameter canopy parachute in use[9]. Further, there is no history of a rough landing or impact against boulders or trees or fouling with aircraft structures. Thus the only violent force that the pilot had been subjected to was the ejection force.

IAF, USAF and Canadian AF ejection injury analysis[1,6-8] does not reveal hollow organ damage due to ejection or Q forces as a significant injury pattern. It may also be argued that the pupil pilot was subjected to near identical conditions of ejection, i.e.,

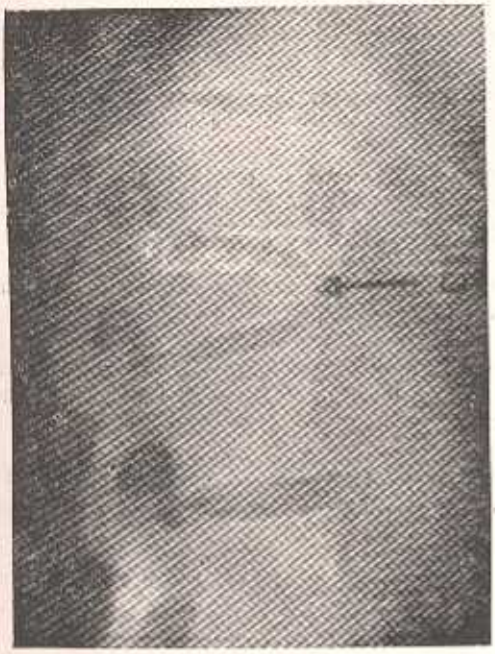

Fig. 1 *Compression fracture of vertebra*

height, landing area etc., but did not suffer any hollow organ injury. Further, rupture of a hollow abdominal organ produces very dramatic symptoms, rapidly going on to local or generalised peritonitis and other severe systemic manifestations. His only consistent complaint was a severe low back ache and spinal tenderness. He was given a morphia injection. This may have masked his pain due to rupture of the abdominal organs. But morphia certainly would not have masked further development of acute pathology which follows a rupture. On laparotomy, after a minute scrutiny of the gut there was no evidence of even the slightest damage. Therefore, rupture of a hollow organ due to ejection, or due to post-ejection injuries does not seem to be the casuative factor of the presence of gas under the diaphragm in this case.

Tear of the Diaphragm

This subdiaphragmatic gas may have appeared as a result of a tear of the pleura and diaphragm of the right side with leakage of lung gases under the diaphragm. But there was no clinical evidence at all to suggest such a severe injury to the lung and diaphragm and hence this theory does not hold good. It has already been pointed out that the ejection or post ejection forces could not have contributed to such an injury.

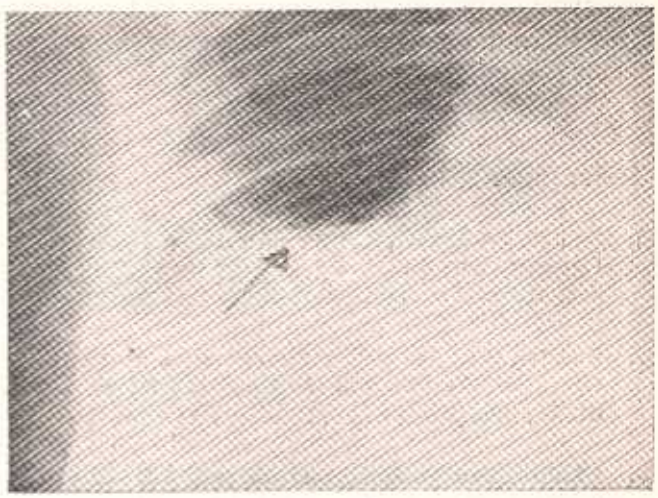

Fig. 2 *Gas under the Diaphragm.*

The presence of a subdiaphragmatic abscess

This may also contribute to the radiological findings of gas shadow under the diaphragm But such an abscess produces severe constitutional symptoms and toxaemia and usually follows a severe illness like an empyema bursting under the diaphragm, acute appendicitis or a perforated peptic ulcer[3,5]. Therefore, in this case a subdiaphragmatic abscess leading to the finding of gas under the diaphragm is not possible as the injured pilot was in a fit condition at all times prior to the accident.

An artefact in the X-ray picture

That the translucent shadow was a gas shadow was established by its presence on two consecutive X-Rays. Highly qualified radiologist and surgeon repeatedly confirmed this to be a subdiaphragmatic gas shadow. Therefore, the possibility of this shadow being an artefact or a misinterpreted finding is remote.

Conclusion

A case of ejection injury has been discussed to bring out a peculiar finding of a subdiaphragmatic gas shadow. The episode of paralytic ileus which explains the progressive painless gaseous distention of abdomen is attirbutable to a state of spinal

concussion due to ejection injury to L1 vertebra. However, the appearance of the gas shadow goes unexplaind.

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