MODERN AIR TRANSPORT AND INVALIDS*

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CIVIL AVIATION has grown steadily and rapidly since the end of the war. London Airport is now handling more than a million passengers a month, and the handling of the disabled and invalid passenger is now a major problem.

The image and convenience of flying have changed greatly over this period, and modern air travel is now extremely well organized and comfortable. The basic physiological cabin environment, however, is not greatly changed since the days when flying was still an adventure.

For economic reasons, commercial airlines are unable to provide a great deal in the way of specialized arrangements for invalids who must, therefore, fit in with scheduled routine services. An airline which catered exclusively for invalids at the expense of other passengers would soon be out of business.

The type of invalid who travels is a typical cross-section of the sick in the community, the majority being elderly and suffering from degenerative diseases. Airlines probably have an even higher share of the elderly, because flying is still relatively expensive.

Invalids who travel can be classified roughly into two groups, those who are self-declared in advance of the flight and can have special arrangements made for them, and those who collapse *en route*, who have either concealed their illness, or were previously healthy. It has been found that, in BOAC and BEA, slightly less than one per cent of passengers declare themselves to be invalids while making their bookings.

In 1966 in BOAC, out of 5,500 self-declared invalids, only 5.5 per cent—that is 288—required any attention *en route*. However, there were some 2,200 passengers who drew attention to themselvs by demanding medical assistance, who were undeclared invalids. On the occasions when it has been necessary to examine medically the

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entire quota of passengers from a civil commercial aircraft, it has been found that approximately ten per cent are disabled in some way or other. In practice, most of the seriously-ill passengers declare themselves in advance; for example, there were 375 passengers carried by BOAC and BEA in 1966, who travelled on stretchers.

The factors which must be taken into consideration when an invalid travels are:

1. The disability of the invalid, the pathology and prognosis of the disease
2. The space and seating configuration of the aircraft
3. The physiology of the cabin environment, the slight reduction in barometric pressure and ensuing mild hypoxia
4. The length of the flight, and whether the passenger is to be accompanied
5. The airline's special regulations with regard to invalids.

1. *The passenger's disability*

It is essential that an accurate diagnosis and a guide to the general condition of the passenger are available. Does the disease affect the passenger in such a way that it interferes with his mobility? Can he still look after himself, feed and toilet himself? Is his intellect impaired? Can he communicate, or is he likely to become neglected or lost? Is treatment necessary during the journey and can the passenger manage this himself? The prognosis must be assessed, and whether the passenger's condition is likely to be improved or deteriorated by delaying his travels.

If the passenger is helpless he will probably need an escort *en route*, especially if the journey is a long one. If treatment is required *en route*, he will probably need a medically-trained attendant.

The cabin staff are trained in first aid only, and cannot administer full medical treatment. Similarly, they are food handlers, and in the interests of hygiene, they cannot toilet invalid passengers.

2. *Space and seating inside the aircraft*

By economic necessity, the seating configuration of modern aircraft is suited to an average passenger. The aircraft also carries the largest number of passengers possible, in comfort. If the passenger has an infirmity, or is deformed in such a way that he cannot sit in an ordinary easy chair, he will not be able to sit in an aircraft seat. Examples are passengers with advanced ankylosing spondylitis, with rigid spines and hips, or passengers with fractured shaft of femur, with full-length plasters from the hip to ankle. Passengers with disabilities of this sort need special seating arrangements.

3. *The effect of the cabin environment*

The most important factor in relation to invalid travel is the physiological environment of the cabin. Modern passenger aircraft

are powered by jet engines which only operate efficiently at high altitudes. The external environment at which these aircraft operate is unable to support human life, so the aircraft are pressurized to conserve an atmosphere inside the cabin which is both safe and comfortable. To operate efficiently, the aircraft has to be as light as possible. The cabin pressure differential, that is the difference between the inside and outside pressures is a compromise between weight and complete comfort. The effect of this compromise is that the cabin pressure is not equal to the barometric pressure at sea level, but to that at the equivalent environment at between 5,000 and 7,000 feet when a modern commercial jet is flying at its cruising altitude of around 35,000 feet. A cabin pressure of the equal of environment at the atmosphere at sea level, which is the ideal for passenger and crew comfort, is alas, too expensive to operate commercially.

The effects of exposure to the cabin environment are twofold:

(*a*). The effects of reduction of pressure of air in the body cavities

(*b*). Exposure to a mild degree of hypoxia.

4. *Effects of reduced barometric pressure*

Gas in the body cavities expands approximately one and a half times, in accordance to Boyle's Law, when the body is exposed to a cabin altitude of the equivalent of 5,000 to 7,000 feet. Gas is found in the lungs, nasal passages, para-nasal sinuses, middle ears, and intestinal tract. Normally, with reduction in pressure, the air expands and escapes through the nearest natural exit.

Passengers who commonly are affected by changes in barometric pressure, are those with disorders in the ear, nose and throat systems. Blocked and inflamed sinuses, or middle ear disease, cause symptoms which are painful, but seldom serious. Gas in the intestinal tract may cause abdominal distension, and the rapid expansion of the gastric bubble may cause symptoms due to pressure under the diaphragm on the heart, such as palpitations or faintness.

Passengers who have had recent abdominal operations, especially if they have a degree of ileus, are particularly at risk from abdominal distension. Stretching of an inadequately healed wound may result in burst abdomen. An interesting use of the effects of abdominal distension is sometimes made by isolated doctors practising obstetrics, who use the air ambulance services. They say an air journey often makes all the difference to a partially obstructed case, and the foetus is literally pushed out from within by the abdominal distension.

Pathological conditions that are at risk to reduced barometric pressure are as follows:

Pneumothorax. The air expands and can further compress the

underlying lung tissue, and may cause mediastinal shift.

Gas in the cerebrospinal fluid circulation introduced for diagnostic reasons, may cause obstruction to the CSF circulation.

Air trapped in dental fillings may cause extreme toothache.

Colostomy and ileostomy may discharge flatus and faeces copiously.

5. *Hypoxia*

Hypoxia is the consequence of reduced barometric pressure, and is a very important consideration in the transport of invalids. Modern jet aircraft, operating at around 35,000 feet, with a cabin altitude of 5,000 to 7,000 feet, expose all crew and passengers to a mild degree of hypoxia. This is quite harmless to the healthy, but may be distressing to the passenger already suffering from impairment of the respiratory, cardiovascular system, or circulation.

The partial pressure of oxygen at sea level is 103 mms of Hg. At 5,000 feet, this falls to 75 mms of Hg, and at 8,000 feet, a cabin altitude that occasionally occurs if the aircraft has to climb to avoid weather or other obstacles, the partial pressure of oxygen is 60 mms of Hg. The oxygen dissociation curves for haemoglobin are such that at partial pressure of oxygen of 70 mms of Hg, the haemoglobin is still almost fully saturated. However, at partial pressures below 60 mms of Hg, the haemoglobin rapidly becomes unsaturated.

Effects of hypoxia are demonstrable at altitudes of 5,000 feet on healthy adults, but these are not dangerous or troublesome. The situation is very different in those at risk to hypoxia. Passengers who suffer from the following common disorders may have their pathological effects potentiated by the mild hypoxia of a routine flight:

Chronic bronchitis and emphysema.
Cardiac failure, congestive cardiac failure, or pulmonary hypertension.
Myocardial ischaemia or infarction.
Hypertension or the sequelae, stroke or renal failure.
A severe degree of anaemia.
Cerebral atherosclerosis may cause disorientation or confusion when potentiated by hypoxia.
The classical disease which is affected by hypoxia, is sickle cell anaemia, in which a sickle cell crisis can be precipitated in both the homozygous and heterozygous forms.

Alas, the common disorders of the cardiovascular and respiratory systems are frequently multiple in the elderly, and complicate and potentiate each other.

6. *The length of flight, and whether the passenger is accompanied*

The length of the flight, the destination, and whether the passenger is alone or accompanied, are factors to be taken into consideration. A severely disabled passenger travelling from London to Paris alone,

is a very different problem to the same passenger travelling to Fiji. The London to Paris flight takes only half an hour, there are good medical facilities at the destination, and it is unlikely that the passenger will need any nursing attention during this short trip. Fiji is 48 hours away from London, with probably at least one change of aircraft. The stages between the various sectors are long, and at some of the refuelling stops, and at the destination, medical facilities may be inadequate. The passenger is also almost certainly going to need some specialized medical or nursing attention during the long journey.

The cabin staff are not nurses, and are trained only in first aid. They are fully occupied looking after the needs of the passengers, and cannot be expected to single out the invalid passenger to the detriment of the others, except in an emergency.

7. *Airline regulations in regard to invalids*

Most airlines have a clause in their regulations which states they have the right to refuse to carry a passenger if they consider that he would suffer by flying, or hazard the other passengers or aircraft. The captain of an aircraft, like the captain of a ship, has the right to off-load any passenger he does not wish to carry. The infectious case, or carrier, is thus automatically excluded. Passengers with any of the disorders liable to deteriorate *en route* may also be excluded.

Unpleasant disorders—the ones usually quoted are skin diseases of repugnant appearance, or passengers with incontinence—may be refused. After all, if a passenger has paid £300 for a ticket, he does not wish to sit for 5,000 miles next to an invalid whose condition is obnoxious.

Pregnancy. Most airlines have regulations which try to reduce the chances of labour and delivery while the aircraft is flying. The last acceptable date of pregnancy is usually around 35 weeks.

Mental illness. This is always a problem, for there are passengers who potentially cause trouble for two reasons. Certain mental conditions render the passenger untrustworthy, for example the paranoid schizophrenic, and may hazard the aircraft or other passengers. Secondly, the passenger may become disorientated and lost.

If we know of mentally-ill passengers in advance, we usually insist on them being escorted by a responsible adult, with or without medical training, depending upon the passenger's condition, the passenger being suitably sedated or tranquillized. Inevitably, there are a large number of mentally-ill passengers who travel on impulse, and present in a lost or confused condition in strange places.

Assistance for invalids

From past experience, and the statistics of invalid travel, commercial airlines show that the self-declared invalid who has been

accepted for travel, and on whom special assistance is given, travals very much better than the invalid who conceals his disability, end has to fend for himself.

Authorization

When a passenger declares himself to be an invalid while buying his air ticket, the airline's medical department should be consulted. This is not because the medical department should act as medical policemen, but the preceding paragraphs have shown there are certain conditions that are particularly at risk when travelling by air. Consultation should take place between the passenger's own doctor and the airline doctor, and the optimum time chosen for travel.

Every declared invalid should be authorized fit to travel by the airline's medical department. The effects of air travel are therefore considered on every case.

The medical department's advice and assistance on invalids

Apart from the initial consultation with the passenger's own doctor, the various departments at the airport can facilitate their travel. The medical department notifies all the departments concerned to anticipate the invalid and to assist where possible. The staff at ticket and check-in points, the immigration and departure lounges, transport to the aircraft, the aircrew themselves and, finally, the route stations and traffic staff at the destination are informed and are given a short description of the disability.

Assistance can be given to passengers who have difficulty for one reason or another in walking to the aircraft, by providing special transport from the aircraft terminal buildings to the aircraft—either by car or ambulance, or wheelchair. A passengers lift, either in the form of a forklift, or other specialized lifting vehicle, can carry the disabled passenger from the ground to the aircraft.

Once on board the aircraft, arrangements can be made for special accommodation for disabled passengers. The passenger can be seated near the door, or near the toilet, given an aisle or window seat. If extra leg room is needed, a bulkhead seat, or a seat in the emergency exit row, can be given. If the passenger still needs extra room, the seating plan can be rearranged, the seat ahead can be turned round, and a bridge put between the two seats, to form a divanette.

If the passenger is too ill to travel in a sitting position, or has to travel recumbent, the seats can be removed, and an invalid couch or stretcher put in their place. The cost of removing the seats and the displacement, may have to be borne by the passenger. The cost depends on whether the fare is sufficient to meet the additional expense. On a short haul airline (for example BEA), this is usually

insufficient, and the cost of a stretcher may be four to six times the cost of a single seat, whereas a long haul airline (for example BOAC) may be able to keep the cost the same as a normal fare. Passengers who travel by stretcher will normally need a trained escort to attend to them and feed and toilet them.

Oxygen is provided for emergency use on all aircraft, in the event of a decompression. This supply may be used for invalids who are at risk to hypoxia. Passengers who are self-declared in advance have a small supply for their especial use should they become embarrassed by the mild degree of exposure to hypoxia during a routine flight.

Worry and anxiety can be allayed by the medical staff taking over the check-in procedures and documentation.

Discussion

The duties of an airline's invalid-passenger branch of the medical department are to advise other departments about invalid passengers, and to assist where and when possible. As shown earlier, only 5.5 per cent of 5,400 passengers self-declared in advance needed any attention *en route*. There were, however, a further 2,200, who drew attention to themselves by requiring medical attention *en route*, who were unnotified or undeclared invalids. Many of these passengers would have been advised to delay their travels, for example, the recent postoperative cases and the recent myocardial infarcts.

Sometimes, if a doctor is on board, he will be able to assist when they collapse, but often they end their travels off-loaded *en route* in a strange country, where medical facilities are inadequate, and often expensive.

The medical department very seldom refuse to carry a passenger, but the passenger may be advised to delay, or to provide an attendant. It is often the extra financial burden of the attendant that causes the passenger to cancel, but this is probably cheaper for the passenger than indefinite medical treatment overseas.

Passengers who are returning to the UK, or to other big centres for specialized medical treatment if none is available locally, and where the alternative prognosis is hopeless, are never refused. BEA have a large commitment between the Channel Isles and London, with cases requiring specialized surgery. However, the coronary case who wants to pop down to the French Riviera, while still very much at risk, or the American who wants to return to the USA from the UK immediately after a perforated peptic ulcer operation with the sutures still in, would be refused until he was out of danger.

Finally, there is the economic factor. Should a passenger collapse soon after take-off, and there is no specialist help aboard the aircraft, the captain is obliged to return to off-load the invalid. Apart from

the waste of a large amount of fuel, the delays and inconvenience to other passengers are considerable, and the medical department should anticipate and prevent such occurrences.

Summary

A commercial airline must be run on economic lines, and invalid passengers must conform and fit in with routine scheduled services. On any flight, there are probably up to ten per cent disabled passengers at any one time. The airline medical service gives advice on the carriage of invalids, firstly by authorization after discussion with the passenger's own physician, and then by arranging assistance as and where needed. This can be done by taking away some of the anxiety by arranging for documentation to be taken over by arranging transport to the aircraft where necessary and meeting the invalid at the destination, by providing special seating arrangements when required, and by providing oxygen.

Finally, other passengers must be protected from the infectious or otherwise dangerous passenger, and the airline protected against the passenger who is liable to cause inconvenience and delays.

The medical service is not a medical police service, but it has been clearly shown that the anticipated invalid travels far better than the undeclared case. Lastly, please do not expect the airline to work wonders if the only notice they get is a short note given to the ticket desk as the passenger departs.

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