

## REFRESHER COURSE FOR GENERAL PRACTITIONERS

## MEDICAL ASPECTS OF AIR TRAVEL—I. ENVIRONMENT AND IMMUNIZATION REQUIREMENTS

BY

Sir HAROLD E. WHITTINGHAM, K.C.B., K.B.E., LL.D. F.R.C.P.

Director of Medical Services, British Overseas Airways Corporation

Now that travel by air has become so commonplace general practitioners are consulted more and more by their patients on its medical aspects. The points on which information is often wanted are the medical contraindications to flying, how babies and the elderly react to long flights, what facilities are available for invalids, and what are the immunization requirements.

First, it is desirable briefly to consider the environment, particularly the limitations of space and other facilities on an airliner, and the effects of speed, altitude, noise, and vibration, as these are all factors of importance in the care and comfort of invalids who contemplate travelling long distances.

## Space and Facilities for Invalids

The space allotted to each passenger is relatively small, even in the most luxurious airliners, and is virtually limited to a seat. Under the best conditions reclining seats are in pairs, with an arm-rest between them, arranged in rows on either side of a narrow gangway 18 to 20 in. (46 to 51 cm.) in width. Each pair of seats is pitched some 39 to 46 in. (99 to 117 cm.) from the next pair, so that there is just room to get in and out past one's neighbour. In some aircraft a number of sleeping berths can be made up at night. There is, of course, an extra charge for these, as there is also for any stretcher space needed; in the latter instance the charge is usually double fare, as two seats are occupied.

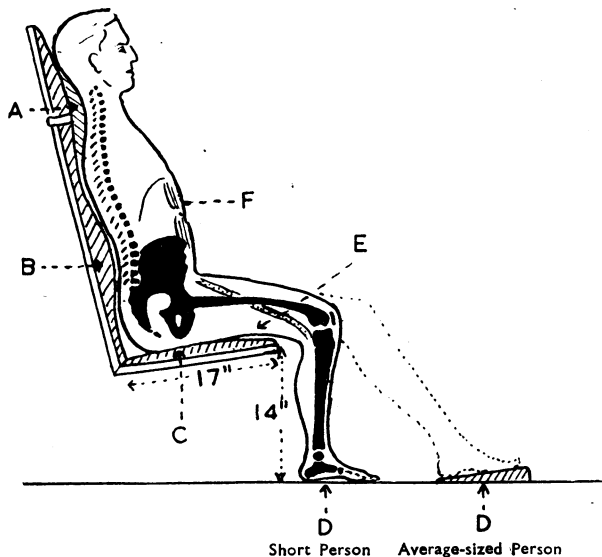


FIG. 1.—Diagram showing anatomical points in aircraft seats. (A) Adjustable support for head and neck. (B) Padding to support small of back. (C) Compression of seat cushion should not exceed 1 in. (2.5 cm.). (D) Feet must reach floor to take weight off lower thighs. A footstool damps vibration. (E) Avoid pressure on main veins and lymphatics and so prevent swelling of feet and ankles. (F) Position prevents abdominal muscles being too relaxed and so lessens pooling of blood in large veins of abdomen and helps to avoid flatulent distension of the gut.

Comfortable seats are essential on long flights of six to twelve hours at a stretch, otherwise passengers cannot rest properly, become unduly fatigued, and suffer from discomfort in the small of the back and from postural oedema of the feet, especially if they have poor circulation. This oedema is largely the result of the seat being too soft and

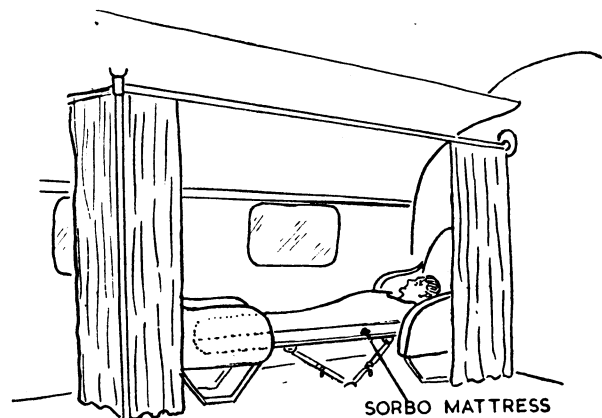


FIG. 2.—Stretcher cot suspended between two chairs and fastened to floor.

too long in the pan, so causing widespread pressure on the veins and lymphatics of the buttocks and underside of the thighs. The backache is due to insufficient support in the back of the seat to maintain the proper curve of the lumbar spine, with the result that the ligaments and muscles concerned are overstretched. Nowadays many aircraft seats are constructed on sound anatomical and physiological principles (Fig. 1), with padding in the right places and tilting devices to enable passengers to adjust their position from upright to reclining and with feet raised enough to prevent oedema. In addition, footstools and soft cushions are available to give further support where required and to suit individual peculiarities of build.

Where necessary or advisable, the airline's medical department recommends acceptance of certain types of invalids as stretcher or sleeping-berth cases only. Special seats are then allotted for the purpose, so that a stretcher can be accommodated or a lie-down constructed by bridging the gap between two facing seats and covering this with a mattress (Fig. 2). Curtains are available to screen off these invalids, particularly those requiring dressings or special attention during the flight.

Toilet facilities in a 40 to 60-seater aircraft are limited to a small "powder room" with two wash-basins and one closet for ladies, and a lavatory with two or three wash-basins, a urinal, and a closet for men. Hot meals are served in flight or at stopping places *en route*, and special diets can be provided for invalids if notification is given in advance.

## Speed and Smoothness of Flight

Speed is not felt in the cabin type of aircraft so long as it is uniform and there are no visual cues, such as passing-by objects like clouds. Alterations in the speed or direction

of the aircraft, however, are felt: the greater the degree of change the more the sensation. Commercial passenger-carrying aircraft are flown so as to cause little or no sensation of speed; in fact, the only time when speed may be appreciated at all is at take-off and during ascent and descent, and even then it is no greater than that experienced in a carefully driven motor-car. Some motion may be felt in "bumpy" weather conditions, especially when flying through cloud, and this may cause airsickness in predisposed individuals. Bad-weather clouds frequently extend up to altitudes of 15,000 to 25,000 ft. (4,600 to 7,600 metres) in temperate zones and to 40,000 ft. (12,000 metres) or more in the Tropics. Modern airliners have therefore been specially designed to fly smoothly and speedily (up to 500 m.p.h.—800 km.p.h.) at altitudes between 15,000 and 40,000 ft. (4,600 and 12,000 metres)—that is, 3 to 8 miles high—and to do this the aircraft has to be "pressurized."

### Effects of Altitude

#### Oxygen Lack or Anoxia

Although the air has the same percentage composition of its component gases at any altitude within the earth's atmosphere, it becomes progressively rarefied with increasing altitude above sea-level in accordance with Boyle's law. At 18,000 ft. (5,500 metres) the air has half the density it would have at sea-level, and at 40,000 ft. (12,000 metres) about one-fifth. This gives a rough idea of the corresponding reduction in the partial pressure of the oxygen available in the air inhaled at different altitudes. Healthy individuals are less affected by lack of oxygen than are the non-robust. The onset of anoxia in flying is insidious, and the symptoms are very similar to those of alcoholism: the individual is oblivious of the fact that he is suffering from lack of oxygen, and, like the inebriated, feels that he is "on top of the world" even when "half under the table." The first symptoms of oxygen deficiency of relatively minor degree occur after a stay of over an hour at an altitude of 10,000 ft. (3,000 metres), but normal individuals and most invalids, if more or less sedentary, can remain in the atmosphere of an altitude of 8,000 ft. (2,400 metres) for ten to twelve hours without suffering anything more than the ennui and fatigue experienced in most modes of travel. Aircraft are therefore pressurized to a degree adequate to compress the air in the cabin (even when the aircraft is flying at an altitude of 40,000 ft.—12,000 metres) to a density of the air at an altitude of 8,000 ft. (2,400 metres) or lower and to maintain it constantly at that density. When invalids are carried, however, the precaution is taken to provide special oxygen sets in case of need, but in practice it has been found that these are seldom required.

Air and other gases contained in the body spaces—for example, the middle ear, the paranasal sinuses, and the alimentary tract—naturally are also subject to Boyle's law, and therefore expand and contract with decrease and increase of the atmospheric or cabin pressure.

#### Ventilation of the Middle Ears

Normally, the air pressure on either side of the eardrums is equalized automatically by the expanding air escaping from the middle ears by way of the Eustachian tubes during ascent and by being drawn in during descent. This ventilation of the middle ears is apt to fail if the Eustachian tubes are even only partially occluded by nasopharyngitis or some other condition affecting their apertures, especially during a rapid descent, as the continuing contraction of the air imprisoned in the middle ears tends to draw together the walls of the Eustachian tubes. Consequently the tympana are drawn in and congestion or even rupture of these membranes may result (acute otitic barotrauma). The immediate symptom is acute earache, followed by some loss of auditory acuity and sometimes by tinnitus and vertigo. These symptoms may persist for some hours after ventilation of the ears has been re-established by the Valsalva technique or, in severe cases, by puncture of the safe area of the

tympanum with a fine needle. It follows, therefore, that those suffering from acute nasopharyngitis or sinusitis should be advised not to fly until they have recovered; if they do fly with a head cold they should inhale amphetamine or some other vasoconstrictors to help clear their Eustachian tubes.

Descents in airliners or alterations in their cabin pressure are usually made very gradually to permit proper ventilation of the middle ears, even if the passengers are sleeping. Young children may get airlocks in their ears: this makes them cry, an act which immediately relieves the condition by opening their Eustachian orifices. Mothers with babies should be instructed to give them a feed or a dummy to suck during ascent and descent. Persons about to travel by air for the first time, and who are apprehensive of their ability to ventilate their middle ears, should be advised to suck a sweet, chew gum, or practise the Valsalva technique during ascent and descent. In fact, this is a wise precaution for all to take, and it is the custom for cabin attendants to hand round to every passenger boiled sweets or chewing-gum at appropriate times.

#### Gases in the Alimentary Tract

Expansion of gas in the gut usually causes no trouble, except the embarrassment of passing flatus. It may, however, create painful distension in those with lax abdominal walls, and may even be dangerous on account of haemorrhage or perforation in cases of active ulceration or after major operations on the stomach or intestines. The general rule, therefore, is not to accept for air travel cases of appendicectomy or herniotomy for ten days after operation, and those who have had gastrectomy or a perforation or haemorrhage of the stomach or intestines (except for haemorrhoids) for at least two months after the event. Colostomy cases are usually not acceptable in the confines of an aircraft, owing to the odour from escaping faeces and flatus. Distension of the stomach and intestines may embarrass those with certain heart and lung conditions by interfering with diaphragmatic movements. Usually, however, alimentary tract distension is automatically relieved by the passage of flatus. It is in the interests of those prone to flatulence to ensure a good evacuation of the bowels before flight, to abstain from gas-producing foods (legumes and excess of carbohydrates), to avoid overeating during the journey, and to absorb some of the gas by means of charcoal biscuits.

#### Noise and Vibration in Aircraft

Noise and vibration of certain frequencies and intensities if continued are disturbing, induce fatigue, and contribute to the onset of airsickness, all of which are apt adversely to affect invalids. Most of the noise and vibration experienced when flying is derived from the engines, though some is from aerodynamic turbulence over the skin of the aircraft. Modern airliners are designed to reduce these defects as far as practicable by using sweeter running engines, by efficiently muffling and orientating exhausts, and by sound-proofing cabins. These measures have proved most effective in jet and turbo-jet aircraft, especially in the former, owing in part to the absence of propellers and pistons and in part to the fact that the engine noise is mainly of high pitch, which is more readily damped down or cut out by sound-proofing than is the lower-pitch noise of the piston engine. Cotton-wool is handed out in all aircraft so that those susceptible to noise can plug their ears: alternatively, passengers can provide themselves with rubber ear-plugs, but these are no more effective than moistened cotton-wool. Such plugs are not really needed in jet and turbo-jet aircraft, which are as quiet as most saloon cars.

#### Airsickness

It is appropriate now to consider airsickness, or motion-sickness, as a number of predisposing factors have already been mentioned—namely, bumpy weather, oxygen want,

fatigue, flatulence, noise, and vibration. Airsickness is rare in pressurized aircraft, which fly above the weather: in fact, the incidence is about 0.6% of all passengers carried, and even then it is usually only a temporary occurrence during ascent and descent when flying through cloud or regions of changing air temperatures in warm climates. It is important, however, to safeguard invalids against airsickness, particularly diabetics, pregnant women, and those with gastro-intestinal lesions such as ulcers and post-operative conditions.

Fortunately, airsickness can be prevented in most cases by the simple expedient of swallowing 1/100 gr. (0.65 mg.) of hyoscine hydrobromide half an hour before the time of take-off. Children under 15 years of age should be given half this dose. (Incidentally, hyoscine has been proved by the U.S. Air Force to be more efficient as a preventive of airsickness than the antihistaminic drugs.) It is rarely necessary to repeat the dose, as acclimatization to aircraft motion develops quickly in most instances, especially if steps are taken to minimize other predisposing factors. It is advisable, therefore, for invalids to be well rested before and during the journey, to obtain a good evacuation of the bowels before flight, to keep comfortably warm, and to plug their ears with cotton-wool to lessen noise.

Motion is felt less near the centre of the aircraft than towards the tail, so seats for invalids are specially allotted. Those who are particularly susceptible to travel-sickness should relax, lie back in their seats, and look upwards, so as to prevent over-stimulation of the labyrinths.

#### Immunization Requirements

In accordance with the International Sanitary Regulations of the World Health Organization, which came into force on October 1, 1952, passengers undertaking international air travel have to be in possession of certain immunization certificates, depending on the place of departure, the countries of transit, and the destination. For most journeys the would-be traveller must have been vaccinated against smallpox within three years, and, if it is intended to pass through or leave a yellow fever zone, immunized within six years against that disease. When travelling from or through cholera endemic areas, inoculation with anti-cholera vaccine is necessary within a period of six months. The immunizations done must be recorded on the international vaccination certificate form prescribed by the World Health Organization, dated\* and signed by the doctor doing the inoculations, and in the case of yellow fever vaccine its origin and batch number must be stated.

Each certificate must then be authenticated and stamped by an authority approved for the purpose by the health administration of the particular country—that is, the Ministry of Health so far as England and Wales are concerned. The approved authenticating authority in England and Wales is the health officer of the town council, urban district council, or rural district council in whose area the doctor practises. These certificate forms are obtainable from the airline company or travel agency concerned or from the Government health department, except those for yellow fever vaccination, which are held at certain recognized centres. Details of immunization requirements can be obtained from the medical or traffic department of the airline concerned, or from the embassies, consulates, or other Government representatives of the countries to be visited. It is most important that travellers should have these certificates completed in all details and have them available with their passports throughout their journey, otherwise they are liable to be subjected to delays, compulsory vaccination, or surveillance, detention in quarantine, or to a fine.

Vaccination against smallpox and yellow fever should not be done at the same time, especially primary vaccination, as this increases the risk of encephalitis. Vaccination against yellow fever should always precede that against

smallpox, because if primary vaccination were done first there would have to be an interval of twenty-one days before giving the yellow fever vaccine. A convenient scheme of inoculations, when all are needed, is as follows: First day: vaccination against yellow fever, cholera, and typhoid group (first T.A.B.); fourth day: vaccination against smallpox; seventh to ninth days: second dose of T.A.B. vaccine, after reading and recording the result of primary vaccination.

If it is decided that it is best for medical reasons not to give a required vaccination, the doctor concerned must certify the fact. It must be appreciated, however, that such individuals may be refused entry into certain countries or be detained in quarantine, and that the airline carrying such persons may have to remove them from the country at its own expense or pay a fine, and the aircraft may be detained. In any case a form of indemnity must be signed by a person who proposes to travel without any necessary certificate of vaccination: this is required to free the airline from any liability if the passenger meets with difficulties or expenses *en route* or on arrival. Conscientious objectors to vaccinations are treated in the same manner as those without valid certificates.

[Part II will appear in our next issue.]

## Nova et Vetera

### AN EARLY CASE OF HAEMOLYTIC JAUNDICE OF THE NEWBORN

During the last few years light has been shed on the condition whereby newborn infants used to perish in a deeply jaundiced state within a few days of birth; before the discovery of the Rhesus factor in the blood and its significance for the infant the occurrence of fatal jaundice which started soon after birth was a sad and hopeless problem. Lately, in searching through some letters written to Sir Hans Sloane and now preserved in the British Museum, one was found which is of historical significance and which, by the kindness of the authorities of the Museum, I am able to reproduce here. It was written to Sir Hans by Dr. George Cheselden, of Leicester, probably a distant relative of William Cheselden. It is dated Leicester, February 25, 1729, and runs as follows:

"At the request of a patient of mine (the bearer) I give you the following short account. The case of the gentlewoman has been very extraordinary. She has had the misfortune to lose 3 fine boys who came into the world with very healthful symptoms for the first 2 days and then the strongest signs of an icterus appear'd the epidermis being all over tinctur'd alike which bad symptoms prov'd most certainly mortal in a few days medicine being of no service to the infants.

"The mother for the generality has good health even when with child only, give me leave to observe that a few days after her quickening her water changed into a true jaundice colour as high as possible and so continues till she is deliver'd, and then as well as usual. Evacuations of all kinds we have made use of in vain alternatives chalybeates and advis'd to no purpose. Last year I advis'd to Scarborough with no better success.

"The last child to all outward appearance was a healthful one excepting the febrick disorder. I therefore importuned the parents that I might examine the Vesica Fell. Ductus Communis in which we found nothing amiss, all the viscera intirely perfect the liver not larger nor harder than common no stone nor obstruction anywhere nor decay in any part nor any part emaciated. The mother's habit of body you'll be better able to judge than I can represent in any letter. I hope that you'll be so good as to put the lady into a more successful method which I do assure you will give a great deal of satisfaction to

sir, your most obedient and humble servant

GEORGE CHESELDEN.

"P.S. One line will be esteemed a favour."

There is no record of the reply from Sir Hans Sloane, but it is to be feared that it would not have contained any solution for the problem propounded.

V. Z. C.

\*The date should be written thus, 3/X/52, to prevent misunderstanding, as in some countries the month is recorded in front of the day.