ROLE OF MEDICAL OFFICER IN THE I. A. F.

WING COMMANDER AJIT NATH
Deputy Director of Medical Services

Medical Officer in the I.A.F., like his colleagues in the Army and Navy, is one of the supporting arms of the men who fight. Our duty is to keep the men who fight in the air healthy and provide them all the medical requirements essential for their morale and efficiency. The duties regarding prevention of diseases, treatment of the sick and injured is very nearly the same in the three Services. It is the medical problems of aviation which are so very different and unless one understands them it is difficult to appreciate the the role or the duties of the Air Force medical officer.

It is a well known fact that military medicine has developed with the military environment of our times. In the last 20 years aerial warfare has created new problems for military medicine. To appreciate the part played by the medical profession in the development of air power as a dominant force, a brief reference to the history of aviation is revealing.

Historical

The first recorded flight in history was made in a fire-balloon on the 19th September, 1783, in Paris. A fire-balloon similar to the ones we see in India during the Dussehra and marriage celebrations. Two years later in 1785, DR. JOHN JEFFERIES, an American physician was the first man to fly across the English Channel in a Hydrogen balloon. During the 19th Century several balloon flights were undertaken. As a result of these flights valuable scientific information was collected about the atmosphere. It is only fifty years ago that the first heavier-than-air machine was flown by the Wright Brothers, on the 17th November, 1903. In the next few years this invention was perfected and by the beginning of World War I, the aeroplane had become a potential weapon of War. The maximum speed of the aeroplane of World War I was 70 m.p.h. and ceiling of 12,000 ft. Engines were very low-powered and a flight of 150 miles was a most remarkable feat. These machines were designed as eyes for the artillery not as fighting machines. Gradually, however, they were armed. First with bags of bricks, then hand grenades, pistols, shotguns, rifles, and later machine guns mounted on wings, synchronised guns came later. These aircraft, besides being technically primitive, had no oxygen system or any of the modern protective devices.

For pilots of World War I, flying was a new environment with its new physical, physiological and mental hazards. Military medicine knew very little about these problems and their prevention. Casualties suffered by the R.F.C. in the first year of World War I, showed that for every 100 flyers put out of action only two lost their lives by enemy action; eight as a result of technical failure while 90 went to hospital or the

Extract from a lecture delivered at the Army H.Q. Medical Exercise 1953.

grave on account of the human factor. This high casualty rate made it clear that proper selection and care of the flying personnel was not only of military importance but an economic necessity. The R.F.C. instituted proper medical care for its flying personnel. Medical officers from the R.A.M.C. and R.N. were attached to the Flying Units. As a result of their efforts casualty rate amongst the aircrew was considerably reduced. In looking after the men who fought in the air, medical officers practised a new form of preventive medicine, which later came to be known as Aviation Medicine. By the end of 1917, the British and the Allies had established a separate medical branch in their Air Forces. The man who built the medical services of the R.A.F. belonged to the I.M.S. He was SIR DAVID MUNRO who was transferred to the R.A.F. in 1917, and was the D.M.S. R.A.F. from 1921-1930, an unusually long period.

Between the two World Wars powerful aero-engines were developed which increased the speed and altitude of aircraft. With the increase in speed and altitude came new medical problems which had not been experienced before. Medical officers had now to find ways and means of increasing human tolerance. Specifications for oxygen equipment, pressure cabin, anti 'G' device, ejection seat and a host of other medical requirements of the pilot, have been written by the medical officers concerned with this speciality. It is due to the solution of various medical problems of aviation by the combined efforts of the doctor, designer and the engineer that man can fly to-day at supersonic speeds and at great altitudes.

Modelled on the lines of the R. A. F., Medical Branch in the I. A. F. was formed in January, 1941 with the transfer of three medical officers of the I. M. S. who volunteered to serve with the Air Force. Our medical officers have a similar role, perform the same duties as the medical officers in the other Air Forces. In addition to their normal work which is prevention and treatment of diseases, Air Force medical officers have special responsibilities connected with selection, training, high altitude flight, high speed flight, survival and safety in flight, air evacuation of casualties, aerial hygiene and psychological care of flying personnel. These are some of the medical problems of aviation.

Selection.

Great importance is attached all over the world to selection of candidates for flying duties, because medical unfitness has an important bearing on flying accidents. Our first duty, therefore, is to select suitable personnel for the I. A. F. Medical rejections in the IAF. is rather high, because our medical standards are much higher than the Army. Medical Standards are fixed in accordance with the job requirement and availability of man-power. Medical; standards, therefore, vary not only in the three Services, but for different branches in each service. In Civil Aviation, medical standards are fixed by the I. C. A. O. (International Civil Aviation Organisation), and the same are enforced by every member nation. India is a member of the ICAO and therefore, our civil airline pilots have the same standard of medical fitness, as the British, French or the American pilots. In the IAF, however, our entry standards are much higher than other countries. For example, we do not recruit pilots who wear glasses which has been permitted in the RAF, due to shortage of man-power in the U.K.

We have a special medical board for selection of candiates for flying duties and serving officers after a period of non-effectiveness. This has been found necessary because of the nature of medical examination, which entails various special tests by trained and experienced examiners. To quote some examples, for eye examination, the Army officers are given four tests as compared to twelve tests for the pilots. Similarly, ear, nose, throat, besides being normal must have certain qualities to avoid difficulty in flying. Both functions of the ear, hearing and equilibrium, must be tested. After every flying accident and even minor illness, medical officer must certify before the pilots and aircrew can resume flying. For proper interpretation of the medical findings and their evaluation in relation to flying duties, a thorough knowledge of the various jobs in the Air Force is necessary.

Training.

Medical officer plays an important part in the training of flying personnel. Training in Aviation Medicine begins in the Flying Academies and continues throughout the active flying career of the pilot. Lectures are followed by demonstrations and individual indoctrination in the Decompression Chamber.

High Altitude Flight.

In aerial warfare, height is an important tactical advantage both for Fighters and Bombers. In fighters, successful interceptions depend largely on the advantage of attacking enemy aircraft from a height. Similarly in bombers, the success of a mission depends on the ability to fly above the anti-aircraft fire and interceptor aircraft. You will, therefore, appreciate why aeronautical development has always aimed to increase the rate of climb and the altitude ceiling of new aircraft.

Since World War I, we have been familiar with the need for oxygen, during flying above 10,000 ft. We also know that flying efficiency is increasingly impaired without oxygen above 18,000 ft; so much so that an average pilot becomes dangerously incapable of flying his aircraft. Altitude has two effects on the human body, one physiological and the other mechanical. Physiological effect is called Altitude sickness or Anoxia. Symptoms are the same as those experienced by mountaineers and known as Mountain Sickness. Acute form of this illness, which is experienced, in flying is called anoxia. With decrease of atmospheric pressure, which occurs with increase in altitude, partial pressure of alveolar oxygen falls, resulting in improper oxygenation of blood.

Brain being the most sensitive organ is the first to suffer. Higher mental faculties are effected first resulting in deterioration in judgement, perception and intellect. Lack of skill in performance of simple tasks, loss of co-ordination of movements and drowsiness develops. Anoxia also reduces visual acuity, night vision and hearing power. Lack of oxygen has been compared to alcohol intoxication. Individual gets a feeling of well being and a false sense of confidence. The person is unaware that anything is wrong. Without a warning you become unconscious. This is the most dangerous feature of anoxia. There is no doubt that in aerial warfare a number of pilots have been killed because the oxygen supply was inadequate or became dis-connected. Even in peace time, the need for oxygen is vital, every time the pilot flies. Our fighter aircraft are fitted with high pressure oxygen system and other aircraft with low pressure oxygen system. Oxygen systems in new aircraft is different and has to be studied.

Pressurisation.

Breathing 100% oxygen one can fly safely upto 40,000 ft. Above that altitude not only pure oxygen, but additional pressure is required for proper oxygenation of blood. Pressurisation of aircraft cabin has simplified most of these difficulties. It has made flights above 40,000 ft. possible. In modern aircraft two methods of pressurisation are employed. First method keeps the pressure in the cabin below 10,000 ft. so that no oxygen is necessary even when you fly at 40,000 ft. This system is used in bombers and civil transport aircraft, e.g. Comet and Constellation. The other method is to use oxygen continuously and keep the pressure inside the cabin below 30,000 ft. This method is used in fighters. Our Vampire and Ouragon aircrafts have got this type of pressurisation.

Although pressurisation has made flights above 40,000 ft. possible it has introduced a new problem of 'Explosive Decompression' i.e. sudden loss of cabin pressurisation which may be caused by mechanical failure or by enemy bullet. Effects of Explosive Decompression on the body are anoxia, severe gas pains and Decompression sickness. Flying personnel have to learn the various aspects of these problems and use protective devices.

Decompression Sickness

Mechanical effects of altitude on the body are Decompression sickness and expansion of trapped gases in the intestines, middle ears and sinuses. The expansion of gases is easy enough to understand. Reduction of pressure increases the volume of the gas in accordance with the Boyle's Law of gases. Gas in the intestines at 20,000 ft. expands six to seven times, its normal volume. Gas producing foods, therefore, give rise to severe intestinal pain. This leads us to the Study of diet for Jet pilots.

Expansion of gas in the middle ear causes Otitic Barotrauma—pain leading to rupture of the tympanic membrane. Expansion of the gas in nasal sinuses gives rise to severe pain of sinusitis and is known as 'Sinus Barotrauma'. These are some of the important causes of non-effectiveness among pilots. Prevention of which requires a constant probe into upper-respiratory hygiene.

Decompression sickness or aero-embolism, commonly called 'bends', is caused by formation of nitrogen bubbles in the body. 'Bends' is akin to 'Cassions' disease. At sea level an average adult body contains approximately 800 cc. of dissolved nitrogen, of which 40 cc. is in the blood, about 360 cc. in non-fatty tissues and 400 cc. in the fatty tissues. With reduction of pressure, nitrogen bubbles out of the blood. Formation of bubbles normally occurs in the synovial membrane of joints and tendon sheaths, giving rise to severe pain in the affected joint. Joints commonly affected are the shoulder, knee, wrist and elbow. Paraesthesia is the other common symptom of Decompression Sickness.

Itching and burning sensations of the skin is presumably caused by nitrogen bubbles in the small blood vessels of the brain the sub-cutaneous fat or in the vicinity of nerve endings. If the bubbles settle down in the small blood vessels of the brain symptoms of neuro-circulatory collapse develop. Flying above 30,000 ft. therefore, is a serious aero-medical problem.

High Speed Flight.

Aircraft speeds have steadily increased during the last fifty years. Modern fighters can fly faster than the speed of sound. Our new Ouragon aircrafts have a top speed of 600 m.p.h. To give you an idea of their speed, these aircrafts can reach Ambala from Palam in 13 minutes. Physiologically, speed has no effect on man provided the flight is in a straight line and the body is protected from the wind blast and friction. We are even now being hurled through space at a speed of 18½ ft. per second by the rotation of the earth, without any deleterious effects. It is the sudden increase or decrease in speed which produces ill effects on the body. This centrifugal force called acceleration or decleration is measured in multiples of the force of Gravity or 'G'. If the force is applied from head to feet it is called positive 'G' and from feet to head negative 'G'.

Living things on earth are used to normal gravitational force of 1 'G' and their reflex actions are geared to respond to such a force. When this force is increased, the body feels heavy. Not only the body as a whole becomes heavier but every part of the body, including the circulating fluids like blood, become heavier. For example if the heart normally forces the blood 12 inches to the head in a sitting posture, when the body is subjected to a force of 5 'G' the heart would have to develop five times as much pressure. This is more than what the normal human heart can do with the result that human beings rapidly loose consciousness, when a force of 5 'G' is applied for five to six seconds.

During flying,'G' is applied to the body in take-offs, pulling out of dives, turns and various other aircraft maneouvres, crashes etc. When the centrifugal force begins to act, the body feels pressed down, movement becomes difficult. At 2.5 'G' it is impossible to get up from a sitting position. At 3 'G' legs and hands cannot be lifted. As the force develops further the subject gradually becomes conscious of fading vision. At 4 'G' peripheral vision becomes constricted and for a second or two one passes through tubular vision. After 5 seconds at 5 'G' central vision first becomes grey and then complete blackout. Fortunately, blackout precedes the loss of consciousness, so that a pilot gets a warning to decrease the stress.

Once unconsciousness develops, even though the force ceases to act, it takes 15 to 30 seconds before consciousness is restored. Some individuals take longer than 30 seconds and go into convulsions before they recover. Consider a plane in a dive at 600 m.p.h. In 30 seconds it travels 5 miles. If flying at that speed, a pilot loses consciousness at 10,000 ft. when pulling out of a dive, the aircraft would go into another dive and hit the ground long before the pilot regains consciousness. Accidents of this nature are not uncommon. From the effects of acceleration it is obvious that a fighter pilot who can withstand higher 'G' than his opponent will have a tactical advantage of great value.

Human centrifuges were built in Germany, America and Canada during World War II and recently in the U. K. for study of acceleration and testing of protective equipment. The protective device which is now commonly used is called anti 'G' suit. Anti 'G' suit works on the principle of counter-acting the pooling of blood in the abdomen and lower extremities by application of external pressure. These suits are worked automatically by a valve which inflates and deflates the suit, depending on the amount of 'G' applied to the aircraft. In modern fighters, 'G' suit has become a normal protective device. It helps to increase the 'G' tolerance by 1-2 'G'. In addition, it cuts down the fatigue. These suits have been tried in Korea recently and have proved useful. Our Ouragon aircraft are also fitted with the anti 'G' device. Recently an anti 'G' valve has been designed in India. A prototype of this valve was recently manufactured by the H.A.L. and has passed the various flight trials.

Survival and Safety in Flight.

Both survival and safety have an important bearing on the morale of flying personnel, because a fighting man will take any risk if he knows that there is some chance of his survival, however, remote and small that chance may be. In the Air Force the question of survival is intimately tied up with the problem of escape, because one must escape from the aircraft first before one has a chance of survival. It is not possible to escape from aircraft at 500 m.p.h. by conventional means of stepping out of the cockpit and opening the parachute. The wind blast and 'G' pushes you back into the cockpit and even if you do manage to get out some part of the aircraft hits the body with fatal consequences. Therefore, all the modern aircraft, fighters and bombers, have been fitted with the ejection seat. Ouragon aircraft has also got the ejection seat.

During ejection, pilot's seat is shot up clear of the aircraft with the help of an explosive. After getting clear of the aircraft the pilot leaves the seat, and continues further descent with the help of a parachute. In aircraft travelling at 500 m.p.h. 40 ft ejection at a velocity of 60 ft. per second is required for safe clearance. This means an acceleration of approx. 20 'G' for one tenth of a second. This high acceleration can be tolerated by the body provided the force is built up gradually and the head is forcibly retained in alignment with the trunk to prevent anterior flexion of the neck on the thorax. Fracture spine is a common injury during ejection. Pilots must be properly trained on the ground in the ejection drill to avoid injury. For this purpose ejection - rig is used.

Troubles of the pilot are not over even after he has managed to eject himself safely. He has still to reach the ground with the help of a parachute. It is interesting to note that a man falling without a parachute from 40,000 ft. will hit the ground in 3 minutes 4 seconds. While with the parachute he takes approx. 24 minutes 32 seconds. The need for oxygen and protection against frost bite during descent, therefore, is an important problem.

This brings me to the question of flying clothing. In modern Jet aircraft one can fly over the Everest wearing a summer suit, but if you bale out chances of survival are very small indeed. Recent study in environmental warmth undertaken by our Aero-Medical Unit has shown that individuals lose upto 2 lbs in sweat in a sortie lasting an hour. Flying clothing worn by our pilots at present is not suitable for our climate. We must develop our own flying clothing. During the early days of open cockpit aircraft, one of our greatest concerns was how to keep the pilots warm. Today we are concerned how to keep them cool, because high speed aircraft are heated appreciably by the friction of air on the outside surface of the aircraft. Training in the use of and serviceability of some of the items of flying clothing like the oxygen mask, 'G' suit, pressure-suit, dinghy life-saving jacket etc. not only determines the success or failure of an operational sortie but the safety of the pilot.

Air Evacuation of Casualties

Our recent experience in Kashmir has shown that even with a handful of transport aircrafts large number of patients can be evacuated by air. From J & K we evacuated nearly 8,000 casualties. We could have evacuated more, if we had a better organisation. For speedy removal of wounded from the battle fields specially trained and equipped casualty air evacuation units proved extremely useful in World War II and recently in Korea. If we are to utilise properly, in any future emergency, the transport resources of the Indian Air Force which are gradually increasing, we must think now.

Aerial Hygiene & Epidemiology.

Air travel has raised new problems of Hygiene and Public Health. Previously, time taken to travel from one country to another by ship or rail was long enough for a disease to become manifest to enable us to take precautionary measures. Now travel time has been reduced so much that a person incubating a disease can go to other countries without detection. Air travel, therefore, has raised new problems of Public Health Control. New International Health Regulations to prevent the spread of infectious diseases have had to be imposed. Health clearance of aircraft is a medical responsibility.

Problems of ventilation, temperature, humidity and control of noxious gases in aircraft cabins is taken into consideration during the design and manufacture of aircraft, but these problems have to be checked every time the aircraft undergoes a major overhaul. In addition, various problems of Industrial Hygiene have to be tackled by the medical officer, since every flying station in the I.A.F. has its own workshops and a large technical population.

Psychological Care.

Flying of modern aircraft demands a very high degree of skill, co-ordination and concentration. Operational flying is far more difficult because the pilot has not only to fly a highly complex machine but must fire his guns and drop the bombs accurately, besides taking evasive action from the enemy. Although aviation has become comparatively safe, flying is still a real and powerfully moving fear. Pilots and aircrew live under constant stress even in peace time. This is not so in the case of a soldier and a sailor. In the IAF deaths amongst the pilots and aircrew in peace time, due to injuries, attibutable to duty is 30 to 40 times higher than that in the Army and Navy. This is true of all Air Forces in the world.

Under normal circumstances, fear of flying is kept within control by flying training, with regular and graduated practice in facing difficulties, flying experience, high squadron morale, sound motivation, social prestige, and self discipline. Individuals who cannot control fear are normally eliminated during flying training. In the Squadrons, flying personnel overcome their fear either by understanding the causes or by facing the difficulty e.g. a pilot who feels afraid of flying a new type of aircraft will try to get more experience and ultimately gain self-confidence. On the other hand, technical or engine failures, aircraft accidents, death of friends in crashes, battle experience, bad weather, financial, matrimonial and other domestic worries cause mental strain or conflict which may eventually result in signs and symptoms of nervous breakdown becoming manifest.

It is extremely rare for flying personnel to throw in the towel without showing any evidence of nervous disorders. All types of variations are met from frank refusal to fly at one extreme to marked nervous signs without failure of flying, to making even an effort to cope with the situation on the other. It is one of the important duties of the Air Force medical officer to watch for minor psychological manifestations before the individual becomes really dangerous in the air and before loss of lives and aircrafts occur.

Once the case is diagnosed, the first thing the medical officer has to do is to eliminate organic disease. Secondly he must differentiate between the psychological breakdown and malingering, hysteria and 'lack of moral fibre' because the disposal of these cases is different. It is the duty of medical officer to advise the C.O. how to remove the causes of stress or mitigate its effects. Even if the stress cannot be removed, as in war, a frank discussion with the M.O. of difficulties and anxieties is a great help.

For the Medical Officer to do his duty in the Air Force it is essential for him to build up good relationship with the aircrew, technical personnel, ground staff and with the C.O. of his Unit. He must build up a spirit of confidence and respect so that the aircrew confide their service, family and financial worries and troubles to him. He must understand the attitudes, habits and manners of the flying personnel under his care. He can only do so if he is interested in all aspects of the Air Force life, flies regularly and is familiar with the various technical details of the aircraft. We must remember that application of medical knowledge is only as efficient as the medical officer's knowledge of the military environment in which he serves. The greatest medical degrees in the world are of little value to an air force medical officer if he is not familiar with the Air Force. What we need in the Indian Air Force is a good basic doctor who loves flying. Without the love of flying one can neither attain proper knowledge of the physiological limitations and various hazards of flight nor gain the confidence of the men one looks after.

Conclusion.

With more and more people taking to air travel and air mastery having become the supreme expression of military power, preventive aviation medicine has gained new importance. Even in a country like ours, where the aircraft industry is still in its infancy and nearly all our aircrafts are purchased from outside, we cannot overlook the problems and need of human efficiency, morale and safety in aerial warfare. To make the I.A.F. a hard-hitting and efficient service, it is our duty to ensure that the airmen are physically fit and mentally alert to use their aircrafts and weapons to their best advantage with deadly accuracy. Let us not forget that "man is the architect of victory in battle; machines and weapons are his bricks and mortar". It is the 'man', who flies and fights in air, we look after.