Review Article

Health monitoring of asymptomatic women aircrew

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Who is an average woman? The average woman does not seek non-traditional career paths. The woman who seeks a non traditional military career will be an intelligent, outspoken student of above average ability, confident, gregarious and competitive by nature and routinely found in leadership positions. Why are we talking about the health monitoring of women aircrew? Though women have been in commercial flying for long, (Capt. Durga Banerjee is one of the senior most commercial pilots along with others) IAF has introduced women in Military flying only since 95. Presently, women aircrew are transport and helicopter pilots. However, the day is not far off when women will be in the fighter cockpits too. This paper mainly discusses women aircrew's necessary health monitoring and the effect of military flying on women aircrew. Whenever required, emphasis will be laid on civil aircrew and also cabin crew.

Integration of women into flight training and Sqn. assignments is far less difficult. Women provide a valuable resource asset. More importantly, women often provide a different insight and approach to problem solving. To be accepted as one of the 'Guys' is the ultimate objective and compliment. Some commanders think that the atmosphere at a sqn has improved considerably with women. In general women tend to be less boastful than men. The introduction of women aircrew in AF may lead to initial problems but there are no absolute contra indication to being aviators except during pregnancy. To strengthen our viewpoint, it will not be out of place to point out that Lady Medical Officers and Nursing Officers have been in uniform for more than five decades.

Health Monitoring

Initial Entry. Initial medical examination standards are similar to both men and women except for a Surgeon's and Gynaecologists examination to rule out any breast or gynaecological involvement.

Medical evidence of organic/congenital disease of the heart, abnormal ECG except for non - specific abnormalities of 'T' waves, and incomplete RBBB are a cause for rejection.

(b) Respiratory. Though asymptomatic, detected cases of Pulmonary Tuberculosis,

Pleurisy with effusion; Bronchitis; Bronchial Asthma and abnormal chest skiagram will be rejected.

(c) GI System. Splenectomy is a cause for rejection.

(d) Urinary system. Abnormalities such as Protienuria, glycosuria, urinary infection and haematuria need investigation. Glomerulonephritis and urinary calculi are a cause for rejection.

(e) Endocrine disorders should be looked for.

(f) Surgical and Spinal Conditions standards are similar for men and women.

Periodical Screening

(a) Cardiovascular. Clinicians should emphasise on primary prevention of cardiovascular disease (CVD) by periodical screening for hypertension, high serum cholesterol and by routinely investigating behavioural risk factors for CAD such as tobacco use, dietary fat and cholesterol intake, and inadequate physical activity. Secondary prevention (Screening) by performing routine electrocardiography in asymptomatic persons is not recommended as an effective strategy to reduce the risk of CAD. It may clinically be prudent to perform screening ECG on asymptomatic females over age 40 (as in the case of males) with two or more cardiac risk factors (hypercholesterolemia, hypertension, cigarette smoking, diabetes mellitus, or family history of early onset CAD); and on those who would endanger public safety were they to experience sudden cardiac events (e.g. commercial airline pilots). Due to lack of data on the effectiveness of the screening ECG, the optimal interval for such testing is uncertain and is left to clinical discretion. The exercise ECG is a more sensitive and specific screening test than the resting ECG.

Special Examination

(a) Breast Examination Clinical breast examination is recommended for all women aged 40 years and above annually. Mammography every one or two years is recommended for all women beginning at age 50 and up to 75 unless pathology is detected. Baseline mammograms before age 50 are not recommended. For the special category of women at high risk because of family history of premenopausally diagnosed breast cancer in first degree relatives, it may be prudent to begin regular clinical breast examination and mammaography at an earlier age. (eg age 35) if

(i) Unsuspected impalpable carcinoma with clinical benign lesion.

(ii) When there are presenting symptoms and as a compliment to clinical findings.

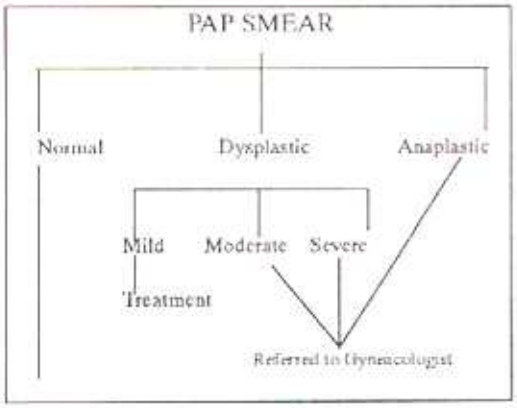
(iii) To reveal unsuspected CA in the contralateral breast.

(iv) Assessing the response after radio/ chemotherapy.

(b) Gynaecological states such as menorrhagia, prolapse and other miscellaneous abnormalities are considered unfit. Papanicolaou tests are recommended for all women as per US studies. PAP tests are appropriately performed at an interval of one to three years, as recommended by the authorised Medical attendant based on

the presence of risk factors (Early onset of sexual intercourse, history of multiple sexual partners, low socio-economic status, and in women >40 years)

For ladies above 35 years a routine PAP smear is advised for early detection of CA cervix.



If there is a case of CA Breast or CA cervix, the medical category and flying status will depend on the diagnosis, treatment and prognosis, Medical waivers may be given depending upon the individual cases' merit.

Pregnancy

Among the millions of passengers transported yearly it is obvious that quite a large number of women must have flown during the early stage of pregnancy. What are the effects of various aviation stresses during pregnancy? The two major concerns are the effects of pregnancy on ability to perform aircrew duties and the effects of the aviation environment on the foetus.

Basic anatomy and physiology are significantly altered during pregnancy for eg a) respiratory response to hypoxia is increased perhaps contributing to dyspnoea. b) Orthostatic intolerence is twice as frequent among pregnant subjects as among non pregnant ladies [1]. Although no centrifuge studies have been carried out on pregnant aircrew, their orthostatic intolerence would perhaps be expected to contribute to lower 'G' tolerance during pregnancy. Danger of incapacitation due to spontaneous abortion, nausea and vomiting and other complications are reasons for restricting flying as early as the first trimester. Weight gains during pregnancy is an additional rationale for restricting flying during the third trimester [2] In addition, pregnancy may exacerbate pre-existing psychiatric problems [3]The effect of 'work' on outcome of pregnancy is also controversial.

Effect on Foetus due to hypoxia

(a) From the pilot's point of view 'hypoxia' is most marked at altitude above 10,000ft. Obstetrics teaches us that during the period of embryonic development, hypoxia can cause malformations and may lead to foetal loss. However, the present day cabin altitude maintained by commercial and military aircraft pose no hazard to the foetus [4]. This is due to the oxygen cascade. Individual measurement of alveolar and arterial values show great variations. Inspite of considerable differences in partial pressures of oxygen, the oxygen saturation alters very little. It is only at an alveolar oxygen pressure of 50-72 mm Hg (depending on pH) that the oxygen saturation falls to about 90%.[5]

(b) Wulfe [6] investigated the effects of hypoxia on the blood gas values of mother and foetus and the results are as follows. Foetal hypoxia is not seen because of two factors [7], physiologically, the foetal dissociation curve lies to the left of the maternal curve and Oxygen saturation of foetal hemoglobin drops less precipitously than maternal Hb on exposure to decrease in pO_2. In addition, during the very early stages of pregnancy, the embryo is nourished by the omphalomesenteric vessels from the contents of the vitalline sac and the vitalene material present in the ovum and these two sources are independent of maternal hypoxia [8]. Table I shows Average blood gas values for mother and foetus. (Mothers breathing atmospheric air or 15% oxygen.)

Aviation Stress

Radiation.

Among the stressors in the aviation environment, the risks of radiation exposure during very high altitude or spaceflight is perhaps the best documented risk to women and the foetus. Radiation is a potential hazard of high altitude flight (above appx 50,000 ft.) Exposure to ionising radiation causes an increased risk of cancer of all types proportional to the magnitude of exposure, although the exact shape of dose response curve is unknown. Differences in male and female anatomy and physiology may affect the epidemiology of radiation induced disease. Although the magnitude of this risks is still negligible during atmospheric flight, space flight may necessitate lower career radiation limits for female astronauts. Another danger of radiation exposure is sterility. Temporary infertility, at least, is more readily induced by acute exposure to radiation in men than in women. Doses required to produce sterility, however are generally above recommended limits based on risks of cancer Radiation poses additional risks of

Table - I

Average blood gas values for mother and foetus, mother breathing atmospheric air or atmosphere with 15% Oxygen (from Wulf [6]).

	Mother's	Brachial Artery	Foetus Umbilical Vein			Foetus Umbilical Artery		
	pO_2 (mmHg)	pH	pO_2 (mmHg)	Mat./Foet Diff.	pH	pO_2 (mmHg)	Art./Ven/ Diff.	pH
Mother breathing atmospheric air (n=63)	90.7	7.435	31.9	58.8	7.386	10.6	21.5	7.3335
Mother breathing 15% O2 (n=63)	64.7	7.412	25.6	39.4	7.404	8.2	17.1	7.350

congenital malformation and mental retardation in the foetus that preclude participation of pregnant female in space flight. There is yet another risk to the offspring in that radiation (intrauterine X-rays) may be possibly be linked to a higher incidence of leukemia and a higher death rate from other causes during the first 10 years of life [9]

Heat.

Heat is another known teratogen, but only core temperatures above 38.9°C (102°F) are likely to be harmful. Temperatures of this magnitude due to heat stress in an aviation enviroment are unlikely except in the most extreme aircraft malfunction or survival situation.

Acceleration.

During early pregnancy the acceleration tolerance is reduced due to the fluid compartment changes. The effects of acceleration on human pregnancy have not been studied extensively. Although, there are no known documented adverse effects of these on the foetus [10], acceleration forces can lead to complications of pregnancy during the first trimester.

Humidity and Pressure Changes.

The low cabin humidity in jet aircraft (8%) appears to be harmless. If gas-producing foods and beverages are avoided pre-flight, then this expansion of intestinal gas could not have adverse effect on the embryo.

Circadian Rhythm.

Though there have been many reports in recent years on the physiological effects of alterations to the circadian rhythm, such as the changed excretion of various steroids (17-hydroxy-corticosteriods, etc), the effects of such alterations, particularly any possible effect on women aircrew and on the developing embryo are not confirmed.

Particle Radiation

Particle radiation is a danger unique to flight outside the earth's atmosphere. In recent studies proton irradiation of female rhesus monkeys has been shown to triple the incidence of endometeriosis. Incident energy and dosage ranges were variable but an increased incidence of endometeriosis was noted even in monkeys. Because of these concerns, it has been recommended that for prospective female astronauts, their career exposure limit of 25 rem be strictly adhered.

Medical Disability

Females present probably a lower risk than males from the point of view of permanent disqualification or incapacitation. Pregnancy is one of the main reasons for female aircrew 'unfit' from flying duties. There are also more injuries among women than men when exposed to the stresses of basic combat training. A review of the incidence of stress fractures in military trainees found that the relative risk for females was increased in the studies accessing male/female differences - relative risks ranged from 3.8 to 10.0 Another study of 124 men and 186 women basic trainees, found an injury rate of 51% among the females compared to 27% among the males.

Most aviators over the years will develop illness which necessitate temporary or permanent disqualification. In men coronary heart disease is most common whereas, in women the two most important conditions

to be monitored are Carcinoma of Breast and Cervix.

Conclusion

The best service to be done to newly introduced women, is to leave them alone, to avoid press coverage, keep them out of centre of attention, give them no special privileges and just let them do their jobs. Pregnancy, including the possibility of foetal damage in the early stages of pregnancy (before diagnosis of pregnancy), appears to be, perhaps, the biggest single medical concern in allowing women unrestricted access to all aviation and space-related careers. The major concern with regard to the fetus is radiation exposure in high altitude or spaceflight. During the later part of their flying career, normal health monitoring along with special emphasis to rule out or detect early CA Breast and CA cervix is to be mandatorily carried out.

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