Anemia in Aircrew

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ABSTRACT

Introduction: Anemia is major health problem in India. Undiagnosed & untreated anemia has severe effect on performance at job. Anemia in aircrew results in disqualification from flying, hence a need is felt to quantify the prevalence of anemia in order to refine our strategy for its diagnosis, identifying its etiology and the final disposal amongst aircrew.

Material and Methods: A retrospective record based analysis of anemia prevalence amongst Indian aircrew reporting for evaluation from 01Jan 2011 to 31Dec 2015 was reviewed and all detected cases of anemia included in the study. Mean of 18 (12 – 27) investigations were performed before reaching an etiological diagnosis.

Results: Out of a total of 14, 212 males and 219 females aircrew that underwent medicals, 224 (1.57%) males and 15 (6.84%) females were found to be anemic. Mean hemoglobin concentration was 11.6 g/dl (9.2 – 12.7 g/dl) in males and 9.8 g/dl (9.1-10.7 g/dl) in females. Microcytic hypochromic anemia was the commonest (79.46%) morphological subtype.

Conclusion: Prevalence of anemia in aircrew is lower than the national prevalence. Since a majority of male aircrew with iron deficiency anemia had a hemoglobin concentration between 12 to 13 g/ dl, revision of cut off to 12 g/dl in male aircrew could substantially prevent down gradation and conserve the trained manpower wastage due to anemia.

Key words: Anemia, Prevalence, Disposal, Microcytic Hypochromic, Hemoglobin

INTRODUCTION

Anemia is characterized by a decreased quantity of red blood cells, accompanied by diminished hemoglobin levels or altered red blood cell morphology.[1] Etiology of anemia is complex. Pathophysiologically anemia is diverse and often multifactorial. Symptoms result from impaired tissue oxygen delivery and may include weakness, fatigue and difficulty in concentrating or poor work performance. Evaluation of the patient with anemia needs a careful history and physical examination. Anemia is common in developing countries, with different studies reporting a prevalence ranging from 7-15 % in males and 30 – 50% in females in the economically productive age group [1,2]. Section 6.16.1 of IAP 4303 4th edition defines anemia to be diagnosed in males with hemoglobin <13g/dl or hematocrit < 39% and in females with hemoglobin <11.5 g/dl or hematocrit < 34.5%.[1] Surveillance of anemia in aircrew is challenging and requires simultaneous understanding of the etiology and its aeromedical implications.

The present study was done to provide an accounting of anemia burden in Indian aircrew. We analyzed the prevalence, the diagnostic approach, the cut offs, morphological subtypes and the etiology of anemia in aircrew reporting for routine medicals.

MATERIAL AND METHODS

This is a retrospective analysis of the medical documents of all the aircrew reporting for evaluation over a period of five years (01 Jan 2011 to 31 Dec 2015). Only freshly diagnosed cases of anemia during this period were included in the study. The demographic details, lifestyle, hemoglobin concentration, co morbidities, diagnostic investigations, final etiology, therapy provided and the aero medical disposal were recorded from the documents. The diagnostic strategy and disposal of these aircrew was further studied to analyse the number and sequence of investigations performed.

The details were noted from history for any concurrent illness, medications and addictions. A general physical examination and hematological investigations like complete haemogram and peripheral blood film examination were carried out in all cases of anemia to classify them into morphological subtypes. Urine and stool was examined for occult blood in all microcytic anemias. Serum iron and total iron binding capacity was also done. Hemoglobin electrophoresis study was done for the qualitative and quantitative analysis of abnormal hemoglobin. Diagnosis of nutritional Iron deficiency anemia was considered in all cases where no other cause of microcytic anemia could be established and the cases responded to therapeutic trial of oral iron. Diagnosis of Thalessaemia trait was arrived after screening positive with Hemoglobin Electrophoresis and confirmation on High Performance Liquid Chromatography (HPLC). Renal disease was confirmed by deranged renal function test and further nephrology workup. Other investigations included electrocardiography, X-ray chest PA and ultrasonography of abdomen. Biochemical investigations included lipid profile, urea, uric acid, lactate dehydrogenase, creatinine and

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standard glucose tolerance test were done to rule out systemic disorders causing anemia. Bone marrow studies were done in most cases of megaloblastic anemia and microcytic anemia refractory to oral Iron.

STATISTICAL ANALYSIS

The information provided was recorded on day to day basis in Microsoft Excel spread sheet windows 7 and evaluated using software package used for statistical analysis (SPSS) version 21. The results were interpreted as percentages.

RESULTS

During the conduct of the study, a total of 14,431 aircrew of Indian origin underwent medicals at the centre. Of these 14, 212 were males and 219 were females. The mean age of aircrew reporting for medicals was 44.3 yrs (24yrs-63yrs). A total of 239 aircrew were detected with anemia (1.65%). The anemic group consisted of 224 (1.57%) males and 15 (6.84%) females. Age wise prevalence of anemia in males and females is shown in Fig 1.

The mean hemoglobin concentration was 11.6g/dl (9.2 – 12.8g/dl) in males and 9.8g/dl (9.1-10.7g/dl) in females. Microcytic hypochromic anemia was the commonest morphological subtype of anemia detected (79.46%).

The prevalence of various morphological subtypes of anemia based upon the complete blood count and peripheral blood film examination are shown in Table 1.

On an average 18.4 (12 – 27) investigations were performed before reaching a final diagnosis out of which 98.6% were within normal limits. 67.5% of males with microcytic hypochromic anemia had hemoglobin between 12 to 13 g/dl. Based on various investigations the different etiologies of anemia were made which are summarized in Table 2 & Fig 2.

S No	Morphological Subtype	Male Aircrew (%)	Female Aircrew (%)
1	Microcytic Hypochromic	178 (79.46)	12 (80)
2	Normocytic Normochromic	30 (13.39)	01 (6.66)
3	Macrocytic	07 (3.12)	01 (6.66)
4	Dimorphic	09 (4.01)	01(6.66)

Table-1: Morphological subtypes of Anemia and their prevalence

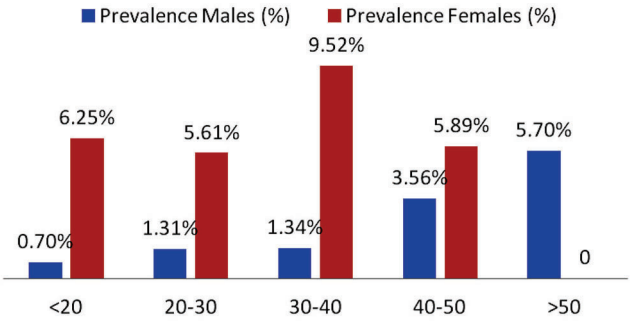

Figure-1: Age wise prevalence of anemia amongst Indian Aircrew

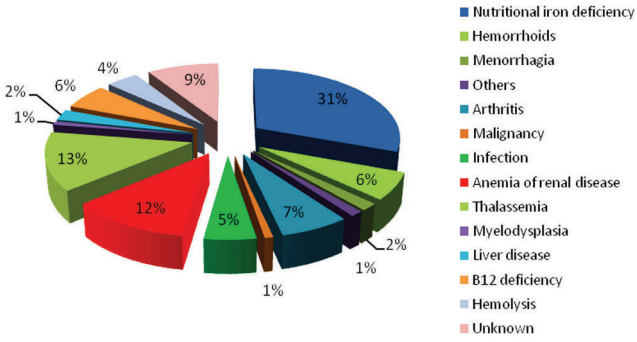

Figure-2: Etiology of anemia in aviators

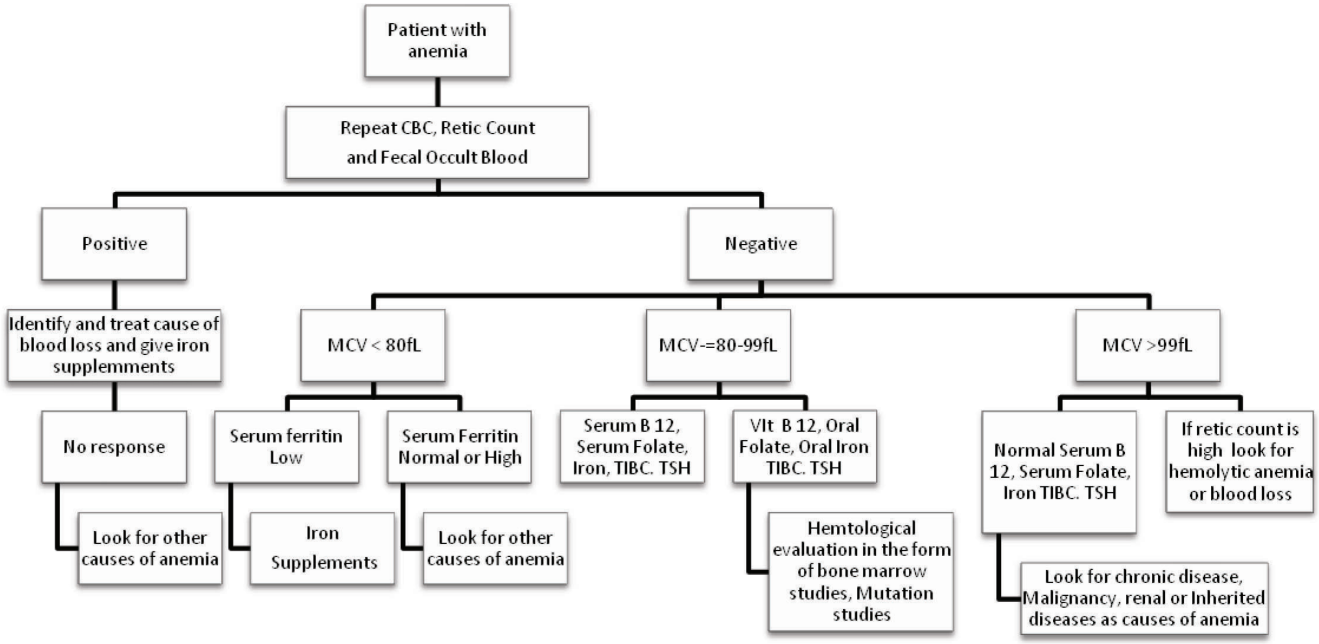

Figure-3: Diagnostic algorithm to evaluate anemia

Diagnosis		Number of patients (%)
Nutritional iron deficiency		73 (30.54)
Iron deficiency due to chronic blood loss		
	Peptic ulcer/Other GI Pathology	15 (6.27)
	Menorrhagia	4 (1.67)
	Others (Gum bleeds & Hemorrhoids)	3 (1.25)
Anemia of chronic disease		
	Autoimmune diseases	16 (6.69)
	Malignancy (CML& Renal cell ca)	2 (0.83)
	Chronic Infection	6 (2.51)
Anemia of renal disease		28 (11.71)
Thalassemia Trait		32 (13.38)
Myelodysplasia		2 (0.83)
Liver disease		12 (5.02)
B12 deficiency		14 (5.85)
Hemolysis		10 (4.18)
Unknown		12(5.02)
Miscellaneous		0 (4.18)

Table-2: Etiology of Anemia in Aviators

DISCUSSION

As per section 6.16.1 of IAP 4303, 4th edn all cases of anemia are to be evaluated in detail to include complete haemogram (PCV, MCV, MCH, MCHC, TRBC, TWBC, DLC, Platelet count, reticulocyte count & ESR) and peripheral blood smear to ascertain the type of anemia into microcytic, normocytic and macrocytic. These tests should be performed before any form of iron or vitamin supplementation.

The diagnostic algorithm followed at this centre to evaluate anemia is outlined in the Figure 3.[2,3] In cases with microcytic hypochromic anemia with no other cause therapeutic trial with oral iron and assessment of reticulocyte response on 10th day was seen on peripheral blood smear.[4] Performing the stool and urine examination for occult blood is a cost effective way of ruling out anemia due to chronic gastrointestinal blood loss which accounts for 15 % of cases of anemia. This also narrows down the spectrum of investigations and gives a direction to the evaluation process.[5]

World Health Organization (WHO) states two billion people suffer from anemia and half of these cases are due to iron deficiency.[6] According to a WHO survey 29% of non-pregnant women and 38% of pregnant women aged 15–49 years were anemic in India in 2011.According to National Family Health Survey (NHFS-4) the prevalence of anemia in Indian women is 53 % in 2015-16 & 23% in men in the age group of 15 to 49 years. India loses 0.9% of its gross domestic product (GDP) due to iron deficiency anemia with a loss of approximate Rs 1.35 lakh crore according to the World Bank's estimate of India's GDP in 2016. The prevalence of anemia in our study in female aircrew is much lower (6.84%) as compared to the female cohort in the WHO survey. Similarly the prevalence of anemia in male aircrew is much lower (1.57%). This could be due to the higher socioeconomic status of aircrew leading to better nutrition and better availability of health services.

Microcytic Hypochoromic anemia is the commonest morphological subtype of anemia, both in male and female aircrew with a prevalence of 79.46% and 80 % respectively. This finding is in agreement with the findings of the studies of Rayman RR & Wintrobe MM. Iron deficiency anaemia (IDA) is the most common form of anaemia worldwide and is estimated to be the cause of up to 50% of anaemia cases.[7] In the developed world, iron deficiency occurs in up to 11% of women aged 20–49 years and 2–4% of men over the age of 50 years.[8] In men and postmenopausal women the commonest cause of IDA is blood loss from lesions in the gastrointestinal tract, making it a common cause of referral to gastroenterologists.[5,6,9] Whereas the prevalence of anemia shows a steady increase with age in males it follows a bell shaped curve in females, being higher in reproductive age groups and finally approaching the male prevalence post menopause. IDA has tremendous effect on human performance mainly the physical working capacity. IDA is also associated with lower intellectual performance, neurological function and intelligence. In our study also IDA is the most common cause of anemia with nutritional iron deficiency as the most common cause of IDA accounting to 30.54%.

The mean Hemoglobin in the anemic cohort was 11.6 g/dl in males and 9.6 g/dl in females. A large majority of male aircrew (67.5%) had a hemoglobin between 12-13 g/dl. A reduction in the cut-off for downgrading the aircrew to non flying medical category could mean that these aircrew could continue to perform their duties while getting evaluated for the final etiology. The diagnostic cut off for anemia are based on certain accepted norms within the medical literature. However, the evaluation for reduction in cut off for anemia needs a systematic evaluation of the performance reduction and g tolerance in presence of anemia and is beyond the scope of this study.[10]

CONCLUSION

Our study highlights the importance of anemia as cause of morbidity and grounding amongst both male and female aircrew. The high prevalence of nutritional iron deficiency anemia in this financially well off cohort points in lacunae in the diet planning. This can be explained by the intake of fast food, packaged food, irregular meals and concurrent intake of large amounts of tea / coffee to maintain wakefulness at odd hours. As 67.5% of cases of anemia in males had hemoglobin in the 12 to 13 g/dl. Revision of fitness to fly criteria to 12 g/dL in male aircrew with nutritional anemia may prevent down gradation of these cases, conserve trained manpower and will also prevent the economic loss due to anemia.

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