

## CHAPTER 6 - HAEMATOLOGY

### 1 INTRODUCTION

Blood transports the oxygen required for, and carbon dioxide produced by the cellular metabolic processes. Any condition reducing these functions affects the individual while the reduced oxygen tension associated with altitude exacerbates any effects. Although the pressurisation of [the aircraft cabin] reduces the [latter] effects the airman [might be faced with low ambient pressure by the emergency of a loss of pressurisation and] must also be able to respond normally to [this] emergency[ ].

### 2 ANAEMIA

[Testing the haemoglobin is required for every examination for Class 1 applicants and for initial examination and when clinically indicated for Class 2 applicants. Applicants with abnormal haemoglobin require a haematocrit test. Haematocrit below 32 % requires an unfit assessment. and further tests as clinically indicated.] Final assessment [depends] on the diagnosis and response to treatment. [Only a temporary unfit assessment is required if the primary cause can be satisfactorily treated (e.g. iron or Vitamin B 12 deficiency) and the haematocrit has stabilised at greater than 32 %. In case of thalassaemia minor or haemoglobinopathies with full functional capability, but without history of crises a fit assessment by the AMS may be considered.]

#### 2.1 Iron deficiency

If the cause can be identified and is not disqualifying, treatment must lead to a haematocrit greater than 32% [before a fit assessment] can be considered.

#### 2.2 Vitamin B12 and folic acid deficiency

After establishing the aetiology and restoring reserves of vitamin B12 or folic acid, a [fit assessment may be considered] subject to [a] follow-up [of at least 6 months].

#### 2.3 Sideroblastic anaemia

Only carriers of the familial type can be [assessed as fit if] the haematocrit is greater than 32%.

#### 2.4 Haemolytic anaemia

[In case of acquired haemolytic anaemia] the underlying conditions must be evaluated and treated [sufficinetly]. Congenital haemolytic anaemia that is not due to a haemoglobinopathy and with haematocrit above 32%, may be considered for [a fit assessment].

Applicants with hereditary spherocytic anaemia can be assessed as fit with a haematocrit above 32% or after successful splenectomy.

Applicants with chronic auto immune haemolytic anaemia are unfit. Decompensation is unpredictable and severe [and may result in sudden incapacitation].

Other rare conditions, or those of obscure aetiology, should be evaluated on an individual basis. These include paroxysmal nocturnal haemoglobinuria, disorders of red cell synthesis or red cell destruction.

### **3 POLYCYTHAEMIA**

For applicants with a haematocrit greater than 55% further investigation is needed to establish the aetiology. After successful treatment resulting in a haematocrit below 55%, [a fit assessment] may be considered by the AMS. Annual review is required.

Polycythaemia vera is normally disqualifying, subject to AMS discretion, due to its [potential] thromboembolic complications and rapid and unpredictable progression.

### **4 HAEMOGLOBINOPATHIES AND THALASSAEMIAS**

#### **4.1 [Sickle cell trait]**

[The red blood cells containing HbS may sickle under low oxygen tension and obstruct blood vessels. This is most likely in individuals, who are homozygous for the disorder (Sickle cell disease, Hb SS). However, even though a lot of applicants with sickle cell trait (Hb AS) have been certified world-wide in the past decades there is no scientific evidence for any complications due to the sickle cell trait occurring in-flight or in altitude chambers. A fit assessment] should be denied when sickling can be demonstrated at reduced oxygen tension [or if there is a history of a sickling crisis.]

[HbSS. If the haematocrit is within the acceptable range and the candidate has no symptoms or history of vaso-occlusive disease, a certificate may be issued.]

[Hb AS. In the absence of conditions such as splenic infarction, Haemoglobin S trait (Hb AS) is acceptable.]

#### **[4.2 Haemoglobin C**

In Haemoglobin C disease (HbCC) the applicant is homozygous for the abnormal HbC. It shows mild anaemia and is associated with , arthralgia, abdominal pain and jaundice. A fit assessment should be denied. In Haemoglobin C trait (Hb AC) the applicant is heterozygous for the abnormal HbC and - except target cells in the thin blood film - there are no haemolysis, anemia or other symptoms. Applicants can be considered for fit assessment.]

#### **[4.3 Haemoglobin SC**

The disorder shows an abnormal Hb S and an abnormal Hb C. It shows a variety of symptoms and] is associated with a high incidence of retinal haemorrhage and splenic infarction. [A fit assessment] should be denied.

#### **[4.4] Thalassaemia**

[Thalassaemia can be subdivided in heterozygous (Thalassaemia minor) and homozygous (Thalassaemia maior) forms, and alpha and beta Thalassaemia (depending on which globin chain of the haemoglobin is deficient). Applicants with Thalassaemia minor can be considered for a fit assessment.]

Applicants with S/B or S/Bo thalassaemia should be denied certification.

Simple, uncomplicated Beta-thalassaemia trait is acceptable.

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## 5 BLEEDING AND THROMBOTIC DISORDERS

### 5.1 Coagulation disorders

Applicants with an inherited coagulation disorder or any history of factor replacement or serious bleeding episodes [must be] considered unfit.

a *Haemophilia*

Applicants with Factor VIII deficiency are unfit. The AMS may consider [a fit assessment] for Class 2, if there is no history of significant bleeding episodes.

b *Von Willebrand's disease*

Applicants with von Willebrand's disease should be [assessed as unfit]. Individuals without therapy or without a history of significant bleeding episodes may be [assessed as] fit by the AMS.

c *Deep vein thrombosis*

A history of deep vein thrombosis requires full investigation for underlying conditions. The individual has to be [assessed as] temporarily unfit.

d *Pulmonary embolism*

Applicants with a history of pulmonary [embolism], not associated with chronic deep venous thrombosis, [have to be assessed as] temporarily unfit until a period of at least 6 months after anticoagulant therapy has been discontinued and not less than 1 year after the actual pulmonary embolism.

e *Recurrent pulmonary [embolism]*

Applicants with more than one episode of pulmonary [embolism] documented by radio-isotopic or angiographic methods are unfit, even if the candidate is asymptomatic. If associated with recurrent injury or special circumstances, [a fit assessment may be considered] at the discretion of the AMS.

f *Arterial emboli*

[Even a] single episode [requires an unfit assessment] because of the high risk of emboli in the brain.

g *Anticoagulant medication*

The use of anticoagulant drugs, such as heparin, coumarin and warfarin, is disqualifying. Following therapy, [a fit assessment] may be considered by the AMS. The use of low dose of low molecular weight heparine may be considered acceptable by the AMS. The use of antiplatelet agents such as acetylsalicylic acid, dipyridole or sulphinyprazone alone for their prophylactic anti-platelet effect is not disqualifying. Ongoing treatment with anticoagulants in an otherwise fit individual, may be acceptable [for Class 2 applicants with a] safety pilot (Class 2 'OSL') [limitation] by the AMS. [(For cardiovascular] requirements also [ ]see JAR-FCL 3.150(c), JAR-FCL 3.270(c), paragraph [10] Appendix 1 to Subparts B and C and Manual Chapter Aviation Cardiology paragraph 9).

h *Haemorrhagic platelet abnormalities*

A decreased circulating platelet count due to any cause may result in debilitating haemorrhagic episodes. Haemorrhage can also occur when platelet counts are normal but platelet function is abnormal. [An individual assessment by the AMS is required.]

## 5.2 Thrombotic disorders

Applicants with idiopathic thrombocytopenic purpura (ITP), previously treated by splenectomy and with stable platelet counts for six months [may be considered for a fit assessment by the AMS] after therapy has been discontinued [ ]. Platelet counts should be repeated at six monthly intervals. Applicants, who have had thrombocytopenia due to abnormal destruction or consumption, as with disseminated intravascular coagulation (DIC), vasculitis or thrombotic thrombocytopenic purpura (TTP), should be [assessed as unfit] permanently.

Persons with thrombocytopenia below  $75\,000/\text{mm}^3$  should be [assessed as unfit]. Some temporary episodes of [thrombocytopenia] can occur in persons with underlying iron deficiency anaemia or other temporary disorders such as recovery from alcoholic bone marrow suppression. [Such conditions require only a temporary unfit assessment until the thrombocyte counts have normalised again, notwithstanding the necessity of further assessment in case alcohol abuse should be suspected (see Chapter 11 Aviation Psychiatry, Subchapter 18.1 Mental and behavioural disorders due to use of alcohol).

[After] a temporary, secondary thrombocytosis that has been resolved and platelet counts have been consistently normal, the AMS may consider [a fit assessment]. Applicants with “essential” thrombocytosis without apparent explanation, who continue to have platelet counts above  $750\,000/\text{mm}^3$ , should be assessed by the AMS.

## 6 HAEMATOLOGIC NEOPLASIA

Applicants with a haematologic neoplasia should be denied [a fit assessment]. Individuals with histories of haematologic neoplasia not requiring continuous therapy may be assessed as fit. Adequate follow-up and re-assessment is necessary because of [the] risk of relapse or progression.

Individuals receiving chemotherapy or glucocorticoids should be assessed as unfit.

### 6.1 Leukaemia

#### a *Acute lymphocytic leukaemia*

Applicants with the diagnosis of acute lymphocytic leukaemia as an adult shall [be assessed as unfit]. Applicants with a medical history of acute lymphocytic leukaemia in childhood may be [assessed as fit,] if they are in complete remission and without treatment for at least ten years.

If the individual has had cranial radiation, particular attention should be paid to examination of the neurologic system and mental status.

#### b *Acute myelogenous leukaemia*

Acute myelogenous leukaemia (AML) or acute nonlymphocytic leukaemia is a very serious disorder and long-term survival is uncommon. Treatment is effective, yet the relapse rate is high and remission lasts only about 15 months on average. An applicant with a history of AML may be considered [a fit assessment] by the AMS.

#### c *Pre leukaemia or myelodysplastic syndromes*

The preleukaemic or myelodysplastic syndromes are a group of haematopoietic disorders that frequently evolve to acute myelogenous leukaemia. They are characterised by hypercellular bone marrow and various degrees of peripheral blood cytopenias. Persons with these conditions are prone to infection and bleeding. Because of the relatively poor

prognosis and high risk of sudden incapacitation, individuals with these disorders should not be [assessed as fit].

d *Chronic myelogenous leukaemia and myeloproliferative syndromes*

Applicants with a confirmed diagnosis of either Ph chromosome-positive or negative chronic myelogenous leukaemia (CML) should be [assessed as unfit] permanently.

e *Chronic lymphocytic leukaemia*

A common staging system for chronic lymphocytic leukaemia (CLL) is as follows:

Stage 0	– bone marrow and blood lymphocytosis only
Stage I	– lymphocytosis with enlarged nodes
Stage II	– lymphocytosis with enlarged spleen or liver, or both
Stage III	– lymphocytosis with anaemia
Stage IV	– lymphocytosis with thrombocytopenia

Individuals with disease in Stage II through IV should not be [assessed as fit]. In these stages of the disease cytotoxic therapy is often necessary and the cytopenias present a serious risk of sudden incapacitation. Persons with Stage 0 or Stage I disease may be [assessed as fit] by the AMS, provided there is no haemolytic anaemia and no requirement for chemotherapy or corticosteroids. Re-examination at intervals of three months should be required with documentation by the treating physician.

f *Hairy cell leukaemia*

Individuals who are stable after splenectomy, or without treatment [may] be assessed as fit by the AMS.

## 6.2 Lymphomas

a *Hodgkin's disease*

Applicants with active Hodgkin's disease or individuals undergoing therapy should not be [assessed as fit]. Persons with Stage I and II-A who have had no evidence of disease for two years after completion of treatment may be [assessed as fit].

Persons with Stage II-B through IV-B should be free of disease and therapy for at least five years before [they may be considered for a fit assessment] and they should be [re-assessed] every six months for ten years. After ten years there should be annual [re-assessments].

b *Non Hodgkin's lymphoma*

Well differentiated and poorly differentiated lymphocytic lymphoma, mixed lymphocytic lymphoma and histiocytic lymphoma of either the nodular or diffuse type, are usually disqualifying. Persons with B-cell, diffuse histiocytic lymphoma, particularly in the early stages, may be cured by radiation therapy and/or chemotherapy. If they are free of disease without therapy for at least three years they may be [assessed as fit] with [re-assessment] every three months for three years and then every six months. Persons with T-cell, diffuse histiocytic lymphoma, including immunoblastic lymphoma and T-cell lymphoblastic sarcoma, should not be [assessed as fit] because of the high degree of malignancy of these disorders and their unpredictability. Cases of Burkitt's lymphoma are usually disqualifying, but may be [assessed as fit] at the discretion of the AMS.

c *Plasma cell dyscrasia*

Applicants with multiple myeloma, Waldenstrom's macroglobulinaemia or multiple plasmocytomas should not be [assessed as fit]. These disorders are not curable, require frequent [toxic] therapy[ ], and are associated with side effects such as neurologic impairment that may lead to sudden incapacitation.

Applicants with a single plasmocytoma may be cured and, if they are free of disease [for] more than three years after therapy has been discontinued, they may be considered for [a fit assessment] with frequent follow-up.

Applicants with benign monoclonal spike gammopathy with a monoclonal spike comprising less than 2 gram/dl of protein, with less than 5% plasma cells in the bone marrow and with no haematopaietic compromise [or] osteolytic lesions, may be [assessed as fit] by the AMS. The major risk of monoclonal gammopathy is progression to multiple myeloma and an increase in serum viscosity leading to neurologic impairment.

Applicants with amyloidosis associated with plasma cell [abnormalities] should not be [assessed as fit] because of the high incidence of organ infiltration and the risk of sudden impairment.

Applicants with gamma or alpha heavy chain disease should not be [assessed as fit]. The median survival is approximately 12 months for gamma heavy chain disease and the alpha chain disease is often associated with abdominal lymphoma.

Applicants with cold agglutinin disease should not be [assessed as fit] because of the risk of sudden haemolysis.

Applicants with cryoglobulinaemia associated with myeloma and persons with the mixed cryoglobulinaemia syndrome should not be [assessed as fit] because of the risk of sudden vascular incidents and neurologic dysfunction.

## **7 SPLENOMEGALY**

Significant enlargement of the spleen is disqualifying due to the increased risk of sudden rupture. The AMS may consider [a fit assessment, if] the enlargement is minimal, stable and no associated pathology is demonstrable. In all cases splenomegaly requires investigation of the cause of the enlargement.

## **[8 BONE MARROW TRANSPLANTATION**

Cases of bone marrow transplantation may be assessed as fit at the discretion of the AMS.]

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