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Aeromedical Decision Making in Coronary Artery Ectasia with Patent Epicardial Coronaries in a Military Aircrew

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Abstract:

Background: *Early detection of Coronary artery disease (CAD) in asymptomatic aircrew with abnormal ECG during annual medical evaluation may identify the individual at risk. If remain unaddressed, it may result in sudden in-flight incapacitation, wherein aggressive risk management with preventive measures would be beneficial. Decision for return to flying duty in a military aircrew with double vessel coronary artery ectasia warranted evidence based approach.*

Case Details: *A 31 years old military helicopter aircrew who was a chronic smoker and consumed alcohol occasionally was detected with inverted T in lead III, V4-V5, flat ST segment in lead aVF and abnormal Q wave in lead V1 in ECG during routine examination. Echocardiography was normal, however, he was detected with provocative ischemia in TMT. He was started on once daily tablet Ecosprin, Clopidogrel and Atorvastatin. Coronary angiography revealed proximal ectasia in left anterior descending (LAD) and left circumflex coronary artery (LCx) with patent epicardial coronaries. 24 hours holter monitoring was normal.*

Discussion: *Aeromedical decision for return to flying was based on comprehensive evaluation to rule out any associated cardiac abnormalities, ascertaining normal coronary circulation, asymptomatic status with NYHA-I functional status, mitigation of risk factors with consideration of clinical prognosis. Ectasia in LAD and LCx was independent of CAD or atherosclerotic lesion. Risk-benefit ratio and prognosis were in favor of flying without restriction in twin cockpit rotary wing aircraft.*

Conclusion: *Prognosis is good for coronary artery ectasia as an isolated pathology to safely get back into cockpit in helicopter and transport operations. Aeromedical disposal of such cases need prompt comprehensive cardiac evaluation to rule out clinically significant CAD along with rational consideration of flight safety with an aim to preserve trained aircrew for flying operations.*

Keywords: *Coronary Artery Ectasia, Aeromedical Decision*

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I. Background

Diffuse dilatation of coronary artery known as Coronary Artery Ectasia (CAE), has been reported to be associated with Coronary artery disease (CAD). Expansive remodeling in response to atherosclerotic plaque growth contributes to its pathogenesis [1]. Etiology comprises of atherosclerosis, chronic smoking, hypertension, narcotic drug (Cocaine), connective tissue disorders, acquired causes viz. emboli, vasculitis, autoimmune and iatrogenic causes. The extent of inducible ischemia in suspected CAD cases during cardiac evaluation gives prognostic information of the disease entity [2, 3]. Being exposed to aeromedical stressors, presence of cardiac pathology in aircrew operating in a high risk environment has flight safety implications. Timely detection of cardiac pathology despite asymptomatic status may help to identify the aircrew at risk. Evidence based risk management process termed as Aeromedical Decision Making (ADM) deals with conscientious, explicit and judicious use of the current evidence to make decision for fitness of aircrew, wherein, evidence based medicine integrates clinical expertise with systematic research generated available clinical evidences [4, 5].

II. Case Details

A 31 years old asymptomatic military helicopter pilot with 600 hours flying experience was incidentally detected with inverted T in lead III, V4-V5, flat ST in lead aVF, abnormal Q wave in lead V1, in

Electrocardiogram during routine examination. On further evaluation, Treadmill test (TMT) was suggestive of exercise induced ischemia. He was an active smoker with 10 pack-years and consumes alcohol occasionally. There was no history of cardiac pathology in his 1st degree relative. He continued to be in NYHA-I cardiac functional status. He used to undertake moderate aerobic exercises every day. Echocardiography, radiology, hematology and biochemistry were normal. He was prescribed once daily oral tablets - Ecosprin 75 mg, Clopidogrel 75 mg and Atorvastatin 10 mg. His coronary angiography (CAG) indicated proximal ectatic changes within the LAD and LCx, accompanied by patent epicardial coronary arteries and preserved coronary flow. 24 hours holter monitoring was conducted to rule out arrhythmia. He was advised lifestyle modification with strict smoking and alcohol avoidance. Presence of autoimmune disease including connective tissue disorders was ruled out by Rheumatologist. Subsequently, he was recommended full flying category.

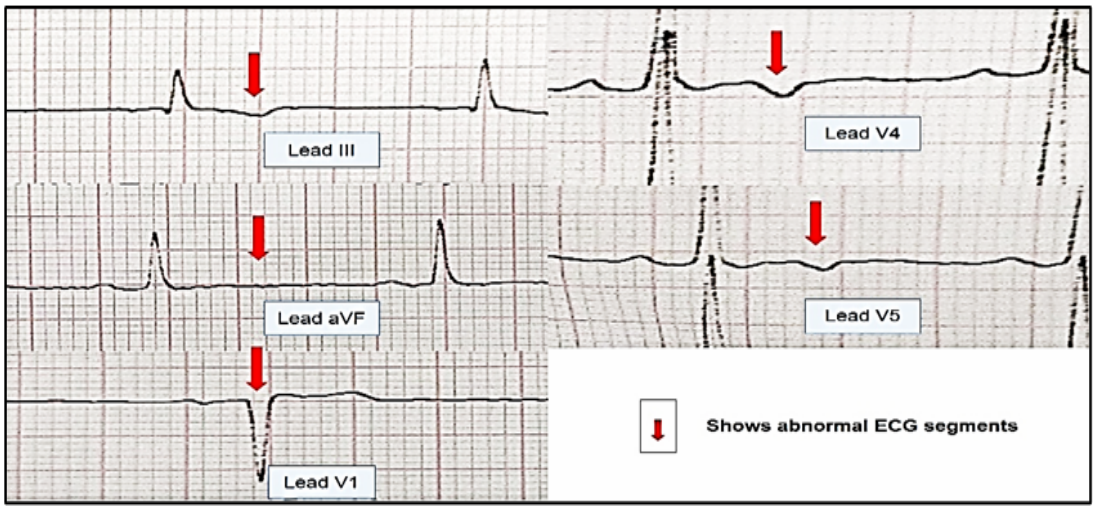

Fig 1: ECG showing T inversion in lead III, flat ST in aVF, Q wave in V1, T inversion in V4-V5

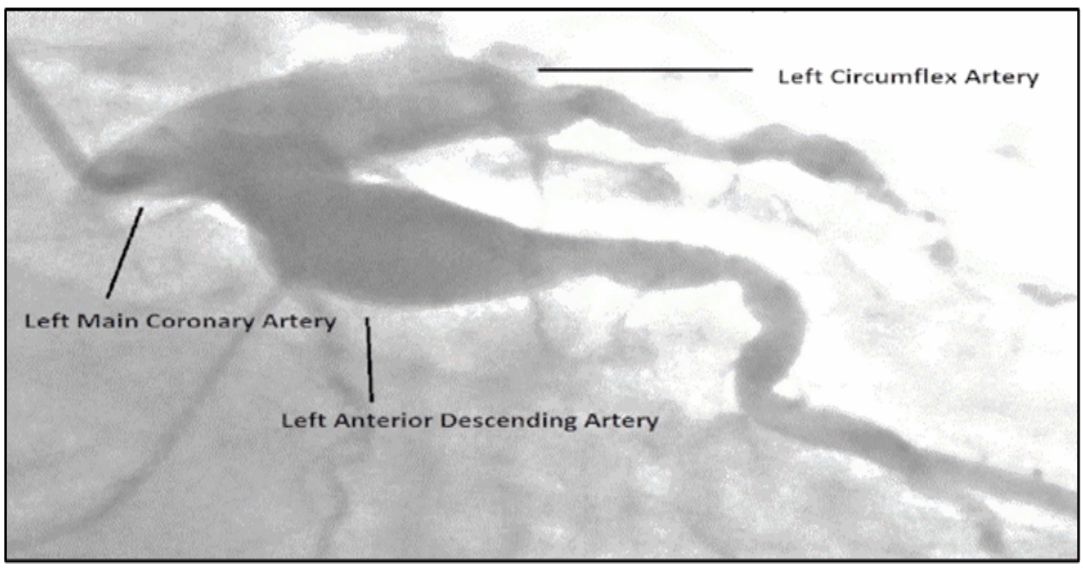

Fig 2: CAG showing CAE in LAD and LCx coronary artery

III. Discussion

Diffusely dilated segment of CAE has a diameter of at least 1.5 times that of the adjacent normal coronary artery [6]. CAE differs from Coronary artery aneurysm which has focal dilatation. CAE has been reported to be found in 3-8% angiography and 0.22-1.4% autopsy. Entire length or segment of coronary artery may be affected in CAE. Atherosclerosis is associated with 50% of CAE cases, whereas 20-30% are congenital. It is associated with connective tissue disorders in 10-20% cases [6]. Literature review suggests that significant microcirculatory disturbances within the ectatic segments warrant prolonged anticoagulation. Prognosis and

treatment of CAE with associated CAD are same as for CAD alone. Albeit equivocal prognosis is mentioned in literature, majority of them mentions CAE in absence of other cardiac disease has good prognosis [7, 8]. Proximally located plaque rupture may increase likelihood of Acute Myocardial Infarction (AMI) with or without presence of CAE. There is a likelihood of collateral flow obstruction to adjacent myocardium as well. CAE with AMI during initial presentation, has higher chance of Major Adverse Cardiovascular Event (MACE) in 04 years follow-up period when compared with those without CAE [9]. However, the risk of MI amongst solitary CAE patients is very low with benign prognosis [10, 11]. Treatment options for CAE include risk factor mitigation, ischemic prophylaxis, aspirin and antithrombotic therapy. Although recommend in literature, no randomized control trial demonstrated the benefit of chronic anticoagulation on CAE. The anticipated benefit must be counterbalanced against the risk of hemorrhage. [12].

In an asymptomatic aircrew on ground with pre-existing CAD, hypoxic hypoxia at altitude may lead to myocardial ischemia. Aeromedical factors and stressful situations during flying operations viz. inclement weather, emergencies, instrument meteorological conditions, night operations, combat manoeuvre etc. may result in tachycardia which may further increase the cardiac oxygen demand. Probability of in-flight incapacitation is high in such conditions. Mild cardiac symptoms may also cause distractions from essential flying tasks. With the advent of widely available sophisticated investigative modalities, coronary pathologies are getting diagnosed promptly. TMT has significant clinical relevance to assess inducible ischemia, in particular conditions viz., extreme stressful activity and tachycardia. CAG was suggestive of CAE in proximal LAD and LCx. Literature survey suggests angiography finding might not always correlate with future acute coronary event risk [13]. Hence, aeromedical decisions must be based on factual, objective data and documentation of the clinical entity [14]. Incapacitation risk data may help in objective decision-making for clinical conditions. ADM is considered as reasonable, replicable and reviewable for the clinical cases [15]. A 'five-step algorithm' may be used for ADM in clinical cases. It includes – Determination of the likelihood of clinically significant event from the health condition; determination of the likelihood of an undesirable aviation event from the health condition; determination of the acceptability of the combined risks; determination of the risk level after clinical intervention for health condition and determination of the risk level after operational restrictions. Determining the likelihood of clinical event, the undesirable aviation outcome, along with acceptability of the risk are deemed important in all cases. If the entity has acceptable risk level, he may be assessed fit. If the risk is too high, mitigation may be explored. Further, the consequence mitigation will only be required if the mitigation of 'likelihood' is unacceptable. Post mitigation of consequences, flying with restriction may be considered [4].

The following facts were taken into consideration during ADM for recommending unrestricted flying category:-

(a) The aircrew was never symptomatic. He continued to carry out his daily activities including moderate intensity aerobic exercise every day with NYHA-I status.

(b) Literature review suggests that CAE without other coronary pathology has good prognosis.

(c) Despite presence of proximal CAE in LAD and LCx, epicardial coronaries were patent. There was no coronary flow disturbance within the ectatic segments.

(d) Echocardiography was suggestive of 65% ejection fraction without regional wall motion abnormality. It did not have coexistence with any other coronary lesions. There was no evidence of arrhythmia in 24 hours holter study.

(e) He did not have any comorbidities. His 1st degree relatives did not have history of any cardiac disease. Modifiable risk factors (smoking, alcohol intake, lifestyle) were satisfactorily mitigated. Improved BMI and reduced WHR were evidenced.

(f) Incidental detection of isolated CAE in an asymptomatic aircrew in the absence of AMI, atherosclerosis, connective tissue disorders, autoimmune disorders and vasculitis, indicates insignificant risk to result in jeopardized coronary circulation.

(g) Cardiologist assessed him fit to resume his duty without any pharmacological intervention (Stress MPI was not recommended as well).

(h) In a dual cockpit rotary wing aircraft, risk of sudden incapacitation during flight was anticipated to be negligible with strict mitigation of risk factors. Monitoring at his unit level was deemed adequate to rule out any pathological progression of the entity.

Determination of likelihood of clinical event, undesirable aviation outcome as well as acceptability of risk level are required to be analyzed in all cases. If the clinical entity is within the acceptable level of risk, the risk- benefit ratio falls in favor of the aircrew. In this case, comprehensive evaluation was suggestive of clinically insignificant cardiac disease. Risk factors (Modifiable) were mitigated with series of counselling. Concerned specialists were in agreement with the favorable risk-benefit ratio. The aircrew was recommended unrestricted flying category. After resuming flying duty, he is continuing with operational flying for more than 01 year without any discomfort.

IV. Conclusion

Application of ADM algorithm improved quality of the decision as an evidence based approach. CAE as an isolated entity is considered to have good prognosis to safely get back into cockpit for transport and helicopter operations. Aeromedical decision for flying certification in CAE cases needs prompt comprehensive cardiac evaluation to rule out clinically significant CAD along with rational consideration of flight safety and preserve trained aircrew for flying operations.

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