Aeromedical Decision Making Paradigms

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V. M. MEDICAL CENTRE

Making a decision takes a moment,
Living a decision takes a lifetime

Sherif A. El-Mawardy

Aeromedical Decision Making (ADM)

- High quality aeromedical decision
  - Reasonable
  - Replicable
  - Reviewable
  - Consistent
  - Using high-level evidence

- Global harmonization of medical fitness standards
- Evidence Based Risk Management Paradigm

Watson DB. Aeromedical decision making: an evidence-based risk management paradigm. Aviat Space Environ Med 2005; 76:58-62
Photo credit - http://www.valuewalk.com/2015/04/josh-kennedy-on-investment-decision-making/

Evidence Based ADM

"The conscientious, explicit, judicious use of the current best evidence in making decisions about aeromedical certification of individual applicants".

Navathe P, Drane M, Preitner C. Aeromedical decision making: from principles to practice. Aviat Space Environ Med 2014; 85:576-80

Case 1

- 41-year airline pilot; >10,000 hrs flying
- Sep 2013 : DGCA Class 1 renewal medical
- Oct 2013 : Atypical chest pain, BP 170/100 mmHg
  ECG: Non-specific ST-T changes
  Workup negative of ischemia / infarct
- Angiogram : **Mid LAD Myocardial Bridge (MB) with 90% systolic compression. No CAD**
- Metoprolol XL 50mg, Diltiazem SR 90mg, Chlorthalidone 12.5mg,
- Low salt diet, yoga, meditation
- Grounded for 12 months (DGCA AIC 28/1999)

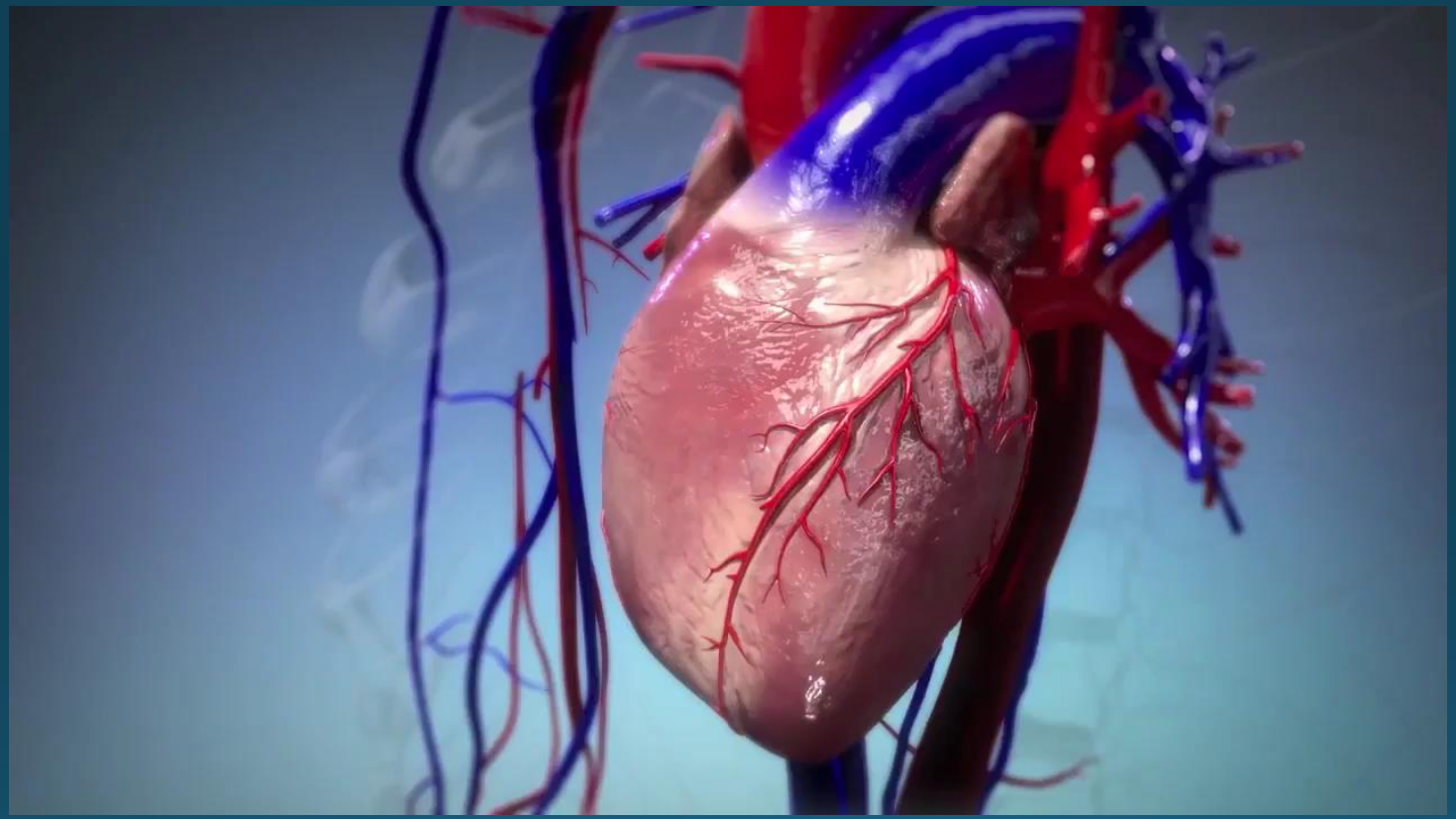
Case 1

- 2014: Myocardial Perfusion Scan – negative for ischemia
  ECG & TMT : Non-specific ST-T changes
  2D Echo: no hypertrophy
  Holter: no arrythmogenicity
  BP well controlled
  Drugs well tolerated
  Asymptomatic

Myocardial Bridge

- Congenital coronary abnormality
- Coronary artery segment tunnels into myocardium, bridge of myocardial fibers
- Commonly LAD (67-98%)[1]

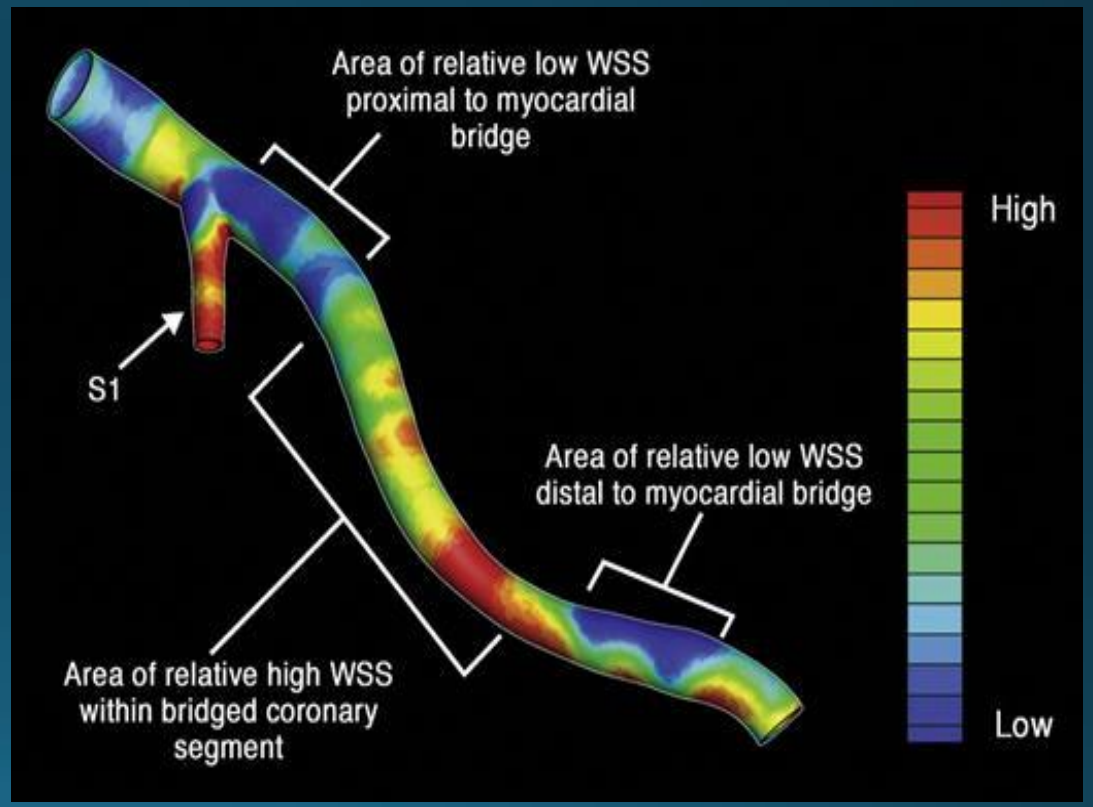
1. Loukas M, Curry B,Bowers M et al, J Anat 2006;209:43-50, Qian JY, Zhang F, Dong M et al, Chin Med J (Eng)2009; 122:632-5
Photo credit - http://www.radiologyassistant.nl/en/p4827512oe2ed5/coronary-anatomy-and-anomalies.html



Video adapted from: http://highimpactcreative.com/project/myocardial-bridge-with-stent-procedure

Incidence, Hemodynamics

- Angiography 1.5-16%, 80% autopsy,[2] higher with multi-detector CT
- Intracoronary doppler, intravascular ultrasonography (IVUS)
- Tunneled coronary artery compressed in each systole
- Tunneled segment spared of atherosclerosis, prone to vasospasm
- Hemodynamic changes ~ angina, myocardial ischemia, ACS, LV dysfunction, arrhythmias, sudden cardiac death[3]



2. Geirenger E. Am Heart J 1951;41:359-368
Photo credit - http://content.onlinejacc.org/article.aspx?articleid=1838320

Presentation & Diagnosis of MB

Pathologically significant >20mm long, 2mm deep

Presentation

- Myocardial ischemia
- Myocardial infarction
- Conduction disorders
- Arrhythmias
- Sudden Death

Diagnosis – Invasive

- Angiography : significant 'milking effect' (accentuated Inj NTG)
- IVUS : 'half moon' sign
- Fractional Flow Reserve (FFR)

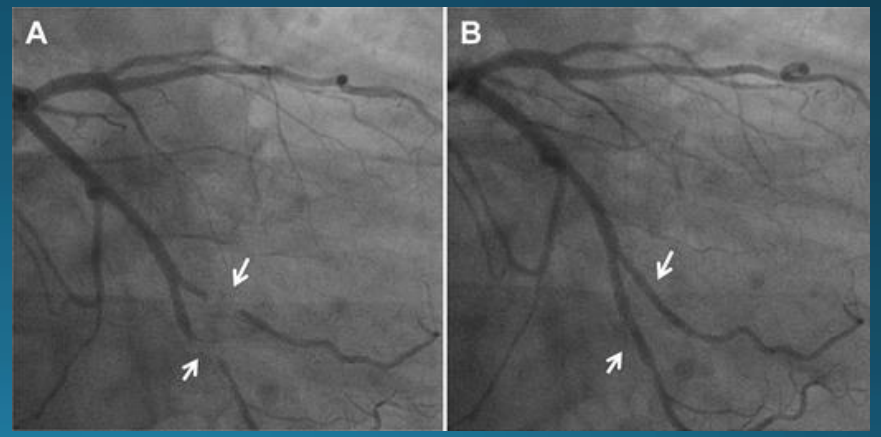


Photo credit - http://content.onlinejacc.org/article.aspx?articleid=1838320

Management of MB

Schwarz guide to therapy[3]

- β blockers cornerstone to therapy
  - ↓ Heart Rate
  - ↑ diastolic coronary filling
  - ↑ contractility of coronary artery
- Calcium Channel Blockers – controls vasospasms
- Pure vasodilators contraindicated – intensifies systolic compression
- Stent, surgery - refractory to medical therapy

3. Schwartz ER, Gupta R, Haager PK, et al. Cardiology 2008;112:13-21

Prognosis

- Good long-term prognosis [4]
- Exercise → Adrenergic release → ↑ HR → subendocardial ischemia, lethal VTach → Sudden Death[5]
- Sudden Death in Hypertrophic Cardiomyopathy and cardiac transplants

4.Juilliere Y, Berder V, Suty-Selton C, Buffet P, Danchin N, Cherrier F, Am Heart J 1995;129:663-5
5. Morales AR, Romanelli R, Boucek RJ, Circulation1980;62:230-7

Case 2

- 50-year airline pilot; >12,000 hrs flying
- Asymptomatic, healthy, non-smoker
- No h/o Congenital Heart Disease, Coronary Artery Disease
- No family h/o Sudden Death
- 2011 – ECG : T inversion
  TMT : Negative
- 2012 – TMT, 2D Echo – normal
  Myocardial perfusion scan – no ischemia
- 2014 – ECG : T inversion, ST depression
  TMT : positive with generalized ST-T changes
  2D Echo : Normal
  Asymptomatic

Case 2

- Coronary Angiography:

  Proximal & mid LAD mild ectasia with slow flow

  Distal LAD Myocardial bridge

  RCA, LCX – mild ectatic with slow flow

  LV Systolic function normal

- Advised Clopidogrel, Atorvastatin
- Observed for 6 weeks for tolerance of drugs

Coronary Artery Ectasia

- Dilatation of arterial segment **1.5 times** normal
- Sluggish blood flow
- Causes: Atherosclerosis, inflammatory disorders, connective tissue disorders, Kawasaki's disease

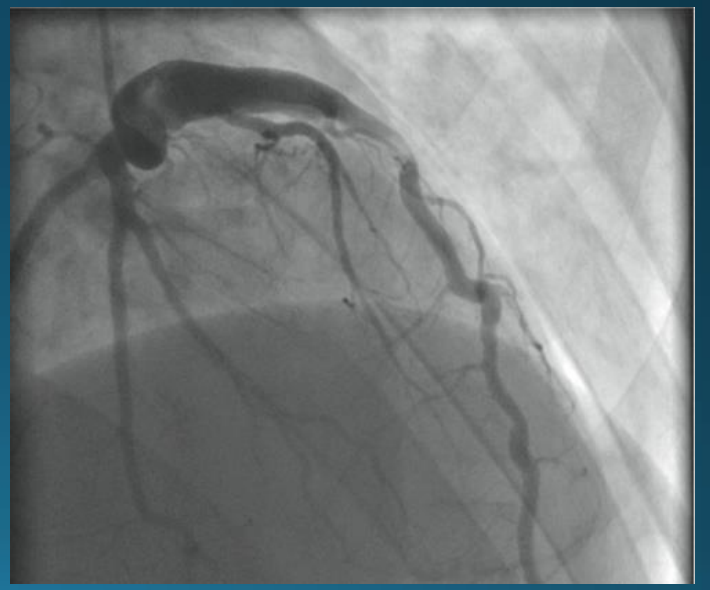


Photo credit - http://www.cathlabdigest.com/articles/Case-Files-Dr-George-Rare-Case-Coronary-Artery-Ectasia-Presenting-Thrombus-Embolization-Acu

Coronary Artery Ectasia

- 3-8% on Angiography, 0.22-1.4% on necropsy[6]
- Majority with CAD
- Hyperlipidemia, unstable angina, MI or death
- Pure ectasia (15%) – benign

6. Hartnell GG, Parnell BM, Pridie RB. Br Heart J 1985:54:392-5

Aeromedical Significance

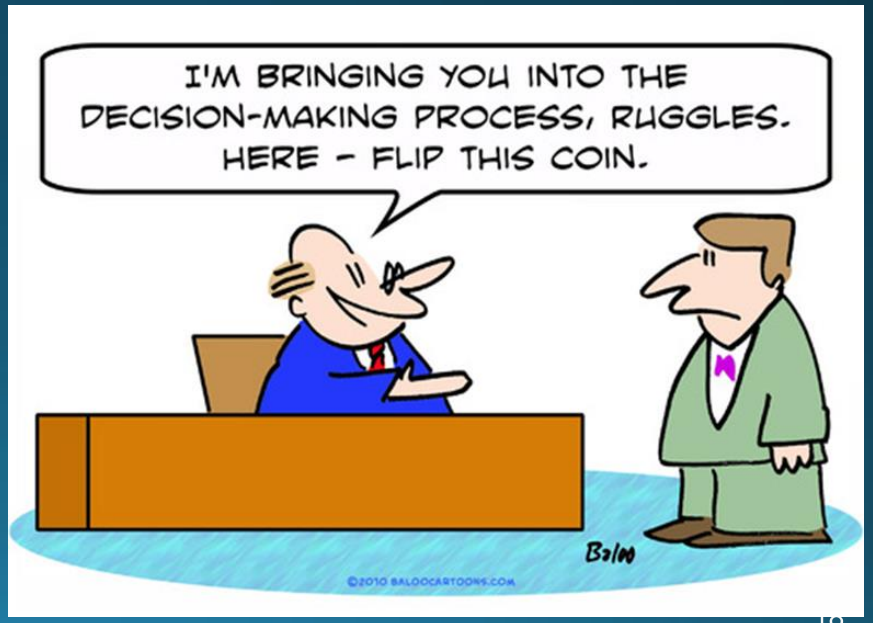
- Significant in-flight incapacitations due to cardiovascular and cerebrovascular conditions[7,8]
- ICAO and Ernsting's Aviation Medicine - MB cause of sudden cardiac death

7. Evans S, Radcliffe S-A. Aviat Space Environ Med 2012;83:42-9
8. Newman D. ATSB Transport Safety Report B2006/0170 Jan 2007

Diagnosis

- **Myocardial bridging**

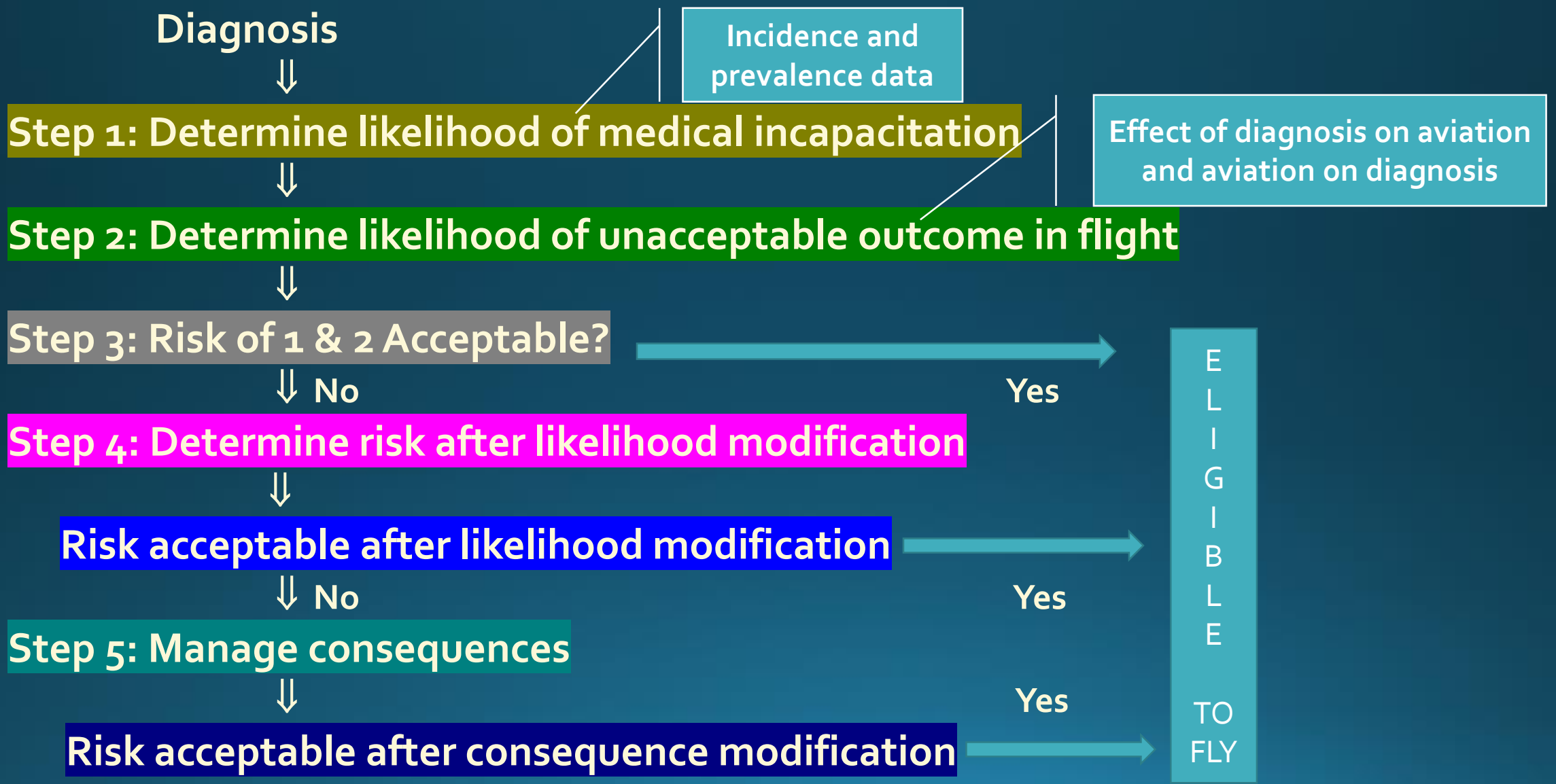
- **Coronary ectasia**
  (rare but potentially incapacitating)



Diagnosis

- **Myocardial bridging**
- **Coronary ectasia**
  (rare but potentially incapacitating)

ADM Algorithm



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ADM Algorithm

Step 1 : Determine likelihood of medical incapacitation?

Evidence based medicine – cardiovascular events and sudden death

Our Pilots –

- No clinical findings
- Not athletes
- No atherosclerosis/ CAD
- No e/o ischemia
- No LVH, Hypertrophic Cardiomyopathy
- No h/o arrythmias, /Holter normal
- No Family history of sudden death
- BP well controlled with no micro/ macrovascular complications
- Drugs (prophylactic) well tolerated

Clinical Event or Sudden Death Unlikely

ADM Algorithm

Step 2: Determine likelihood of Unacceptable outcome in flight?

1. Effect of MB/ ectasia on flying – No

1. Effect of the flying on the diagnosis – No

ADM Algorithm

Step 3: Risk of 1 & 2 Acceptable?

Acceptable risk in Case 2

ADM Algorithm

Step 4: Determine risk after likelihood modification (Risk mitigation)?

Case 1:

- **Medications -** ↓ risk of hypertension, arrythmias, sudden death
- Annual cardiologist's review

→ **↓ likelihood of clinical event**

↓

Acceptable risk

ADM Algorithm

Both Cases – Fit to fly unrestricted

ADM for sudden incapacitation (Useful for certification decisions)

Assessed risk > Acceptable risk → Risk treatment, aimed at reducing / mitigating likelihood and/or the consequence of risk

Assess applicant's functional capacity to determine adequacy for class of medical certificate, type of aircraft or operations

Doubt in functional capacity → consider limitations of applicant against aircraft requirements

Identifies steps in process of ADM, helps improve transparency, quality of decisions, identifies more clearly the areas of uncertainty or disagreement, makes decisions more defensible.

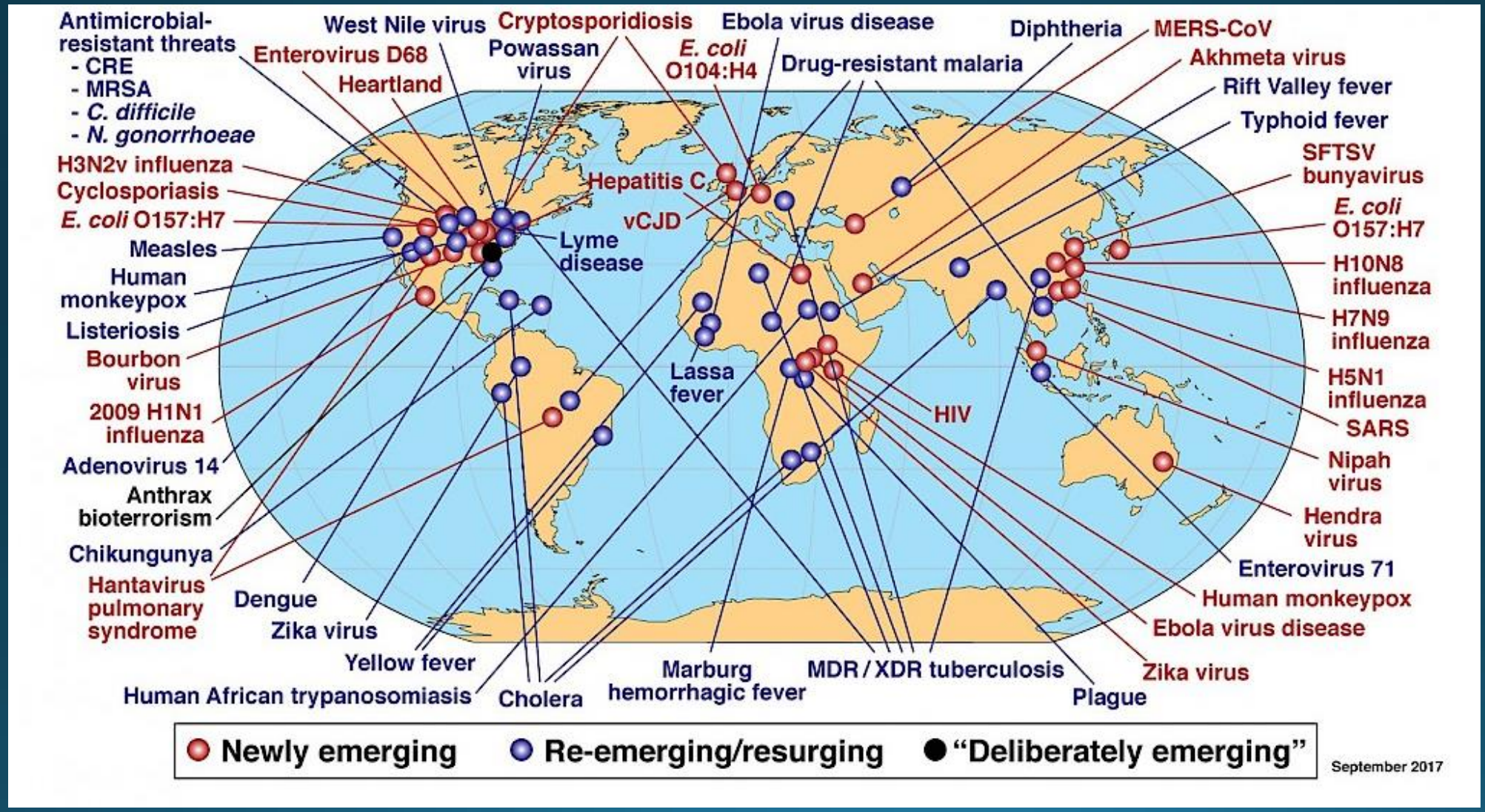
Acute and short-term medical diagnosis like infections??

Useful for interval conditions : events occurring during existing certifications??

Case 1

- 24 year cabin crew
- h/o loss of appetite
- Chest X-Ray – Pleural effusion
- Anti Tubercular Treatment for 9 months
- Review medical board
- PFT, CXR, Clinical biochemistry normal
- Reflighted after 1 year

Global examples of Infectious diseases



Common infections in crew

- COVID-19
- Malaria
- Amoebiasis
- Tuberculosis
- Dengue
- Chikungunya
- Hepatitis
- Ear infections

Infectious diseases in crew – It's Real (occupational hazard)

- Crew infected at base
- International travel – during layovers
- Frequent (International) Travel
- Physical proximity to passengers
- Hands on procedures in aircraft
- Contact with contaminated surfaces, materials

- Aviation industry personnel - greater occupational exposure risk to airborne biohazards, blood and other infectious materials than healthcare workers

Aeromedical Decision Making (ADM) for return to work

“When recovery is complete”

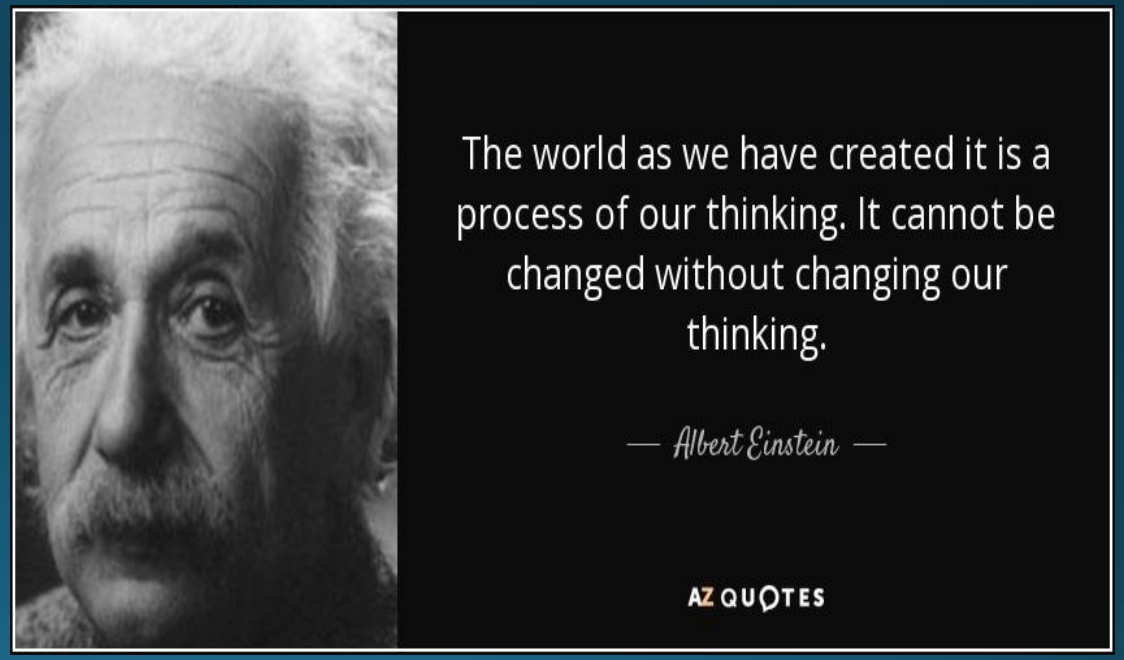
- ? Clinical
- ? Biochemical and radiological recovery
- ? Cessation of medications
- ? Crew symptoms
- ? Treating Dr’s fitness letter
- ? Employer’s unwritten policy

The Question?

"How soon is too soon, how long is too long?"

Current Practices & Outcomes

- Clinical and biochemical recovery driven, clinician driven, cessation of medications, crew driven, employer unwritten policy driven
- Longer grounding, financial and operational burden with no significant clinical justification



New ADM Paradigm

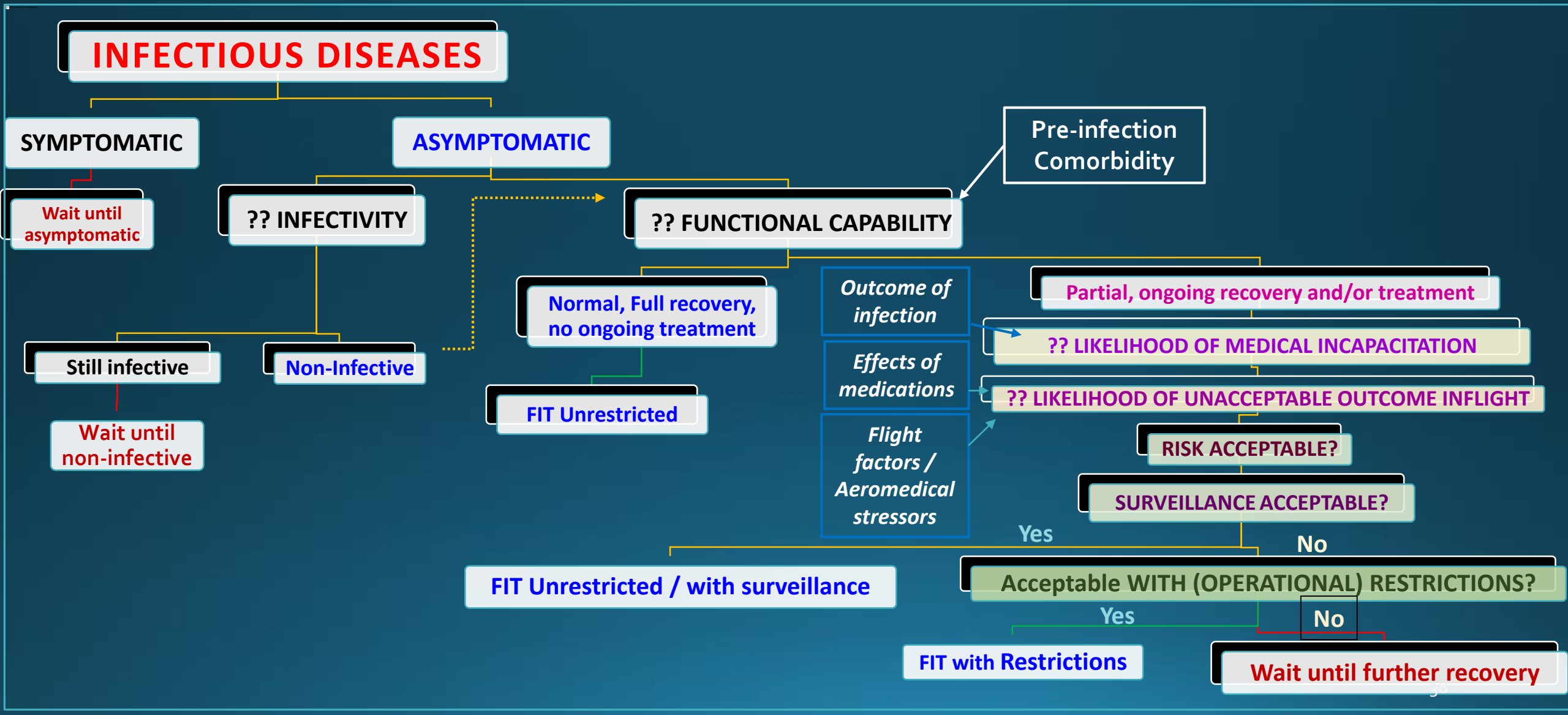
Current Practices & Outcomes

- Clinical and biochemical recovery driven, clinician driven, cessation of medications, crew driven, employer unwritten policy driven
- Longer grounding, financial and operational burden with no significant clinical justification

Expected Outcomes

- Scientifically based, consistent decisions, consider early re-flighting without jeopardising safety
- Asymptomatic, non-infective, with adequate functional capability and acceptable risk due to ongoing treatment can return to flying
- Utilisation of trained resources
- Significant reduction in period of grounding of crew

ADM Paradigm for infectious diseases



ADM by AMEs/ Company Doctors

Worksheet/ Checklist

1. Asymptomatic
2. Non-infective (…)
3. Functional capability tests (…)
4. Clinical recovery (as per treating specialist)
5. Biochemical recovery (…)
6. Radiological recovery (…)
7. No side effects of past/ongoing medications
8. No conditions of aeromedical significance
9. Acceptable surveillance
10. Comorbidities do not worsen recovery

Worldwide practices

Thank you!

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