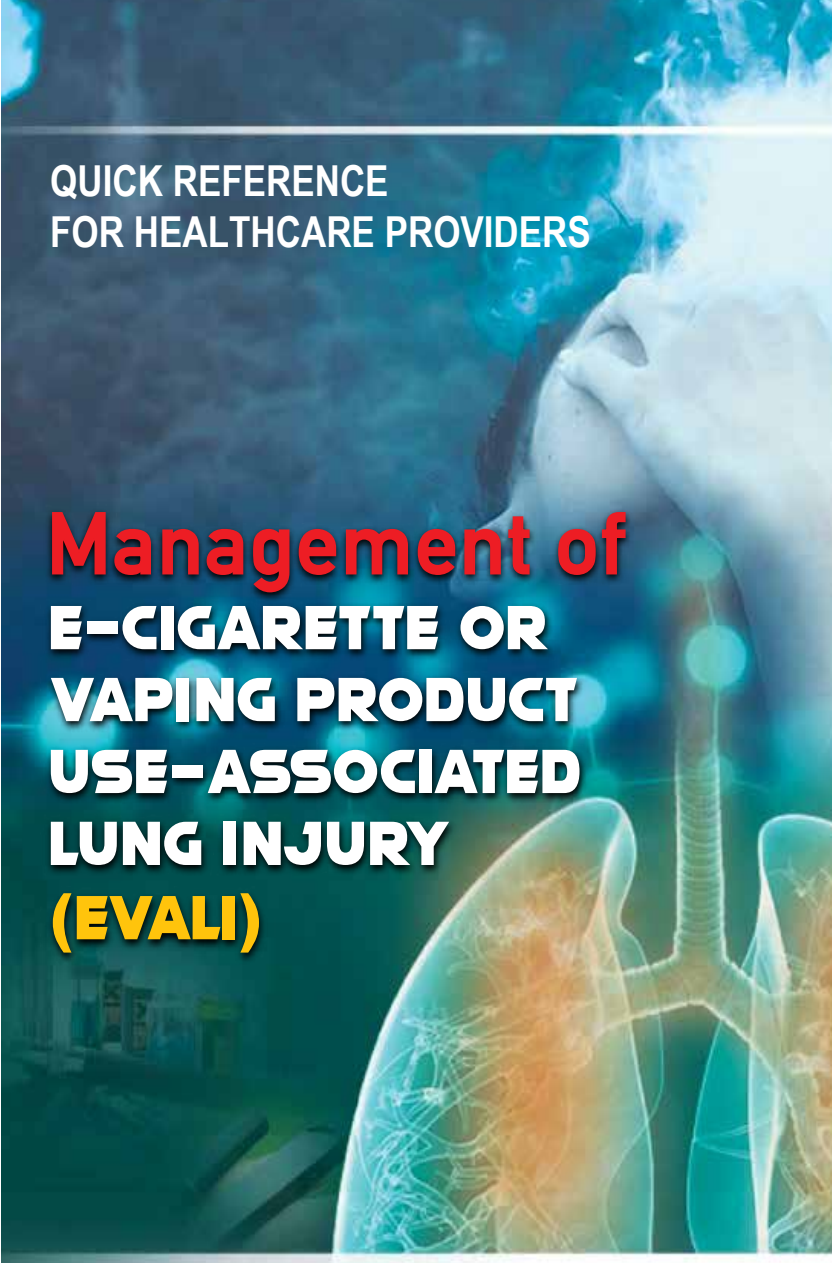
QUICK REFERENCE
FOR HEALTHCARE PROVIDERS

Management of E-CIGARETTE OR VAPING PRODUCT USE-ASSOCIATED LUNG INJURY (EVALI)



Ministry of Health Malaysia

Academy of Medicine Malaysia

KEY MESSAGES

1. Electronic cigarette or e-cigarette (e-cig) is a handheld device equipped with aerosol generator, battery & solution storage area. Its purpose is to deliver nicotine or other chemicals via aerosolisation.
2. Inhalation of e-cig aerosol could potentially cause physical (including organ) & psychosocial damage (refer to page 3).
3. E-cigarette or Vaping Product Use-Associated Lung Injury (EVALI) is defined as history of e-cig use within 90 days of the onset of symptoms with pulmonary infiltrate on imaging & no other contributable cause of the illness. The diagnosis of EVALI should be made based on case definitions as outlined by the United States Centers for Disease Control and Prevention (refer to page 4).
4. EVALI patients may present with respiratory (shortness of breath, cough & chest pain) & gastrointestinal (nausea, vomiting, diarrhoea & abdominal pain) symptoms while tachypnoea is commonly observed.
5. A physician should be consulted for any case suspected of EVALI at the emergency department or primary care facility.
6. Relevant laboratory investigations should be done to rule out other probable diagnoses before diagnosis of EVALI can be made.
7. Chest imaging should be done in all suspected EVALI cases.
8. Bronchoscopy may be performed if clinically indicated to exclude alternative diagnosis & not to confirm EVALI.
9. For patients suspected or confirmed of EVALI diagnosis, supplemental oxygen, antibiotics & systemic corticosteroids may be initiated if indicated.
10. Patients with EVALI should only be discharged when they fulfil the discharge criteria with hospital prescription & follow-up.

This Quick Reference provides key messages & a summary of the main recommendations in the Clinical Practice Guidelines (CPG) Management of E-cigarette or Vaping Product Use Associated-Lung Injury (EVALI)

Details of the evidence supporting these recommendations can be found in the above CPG, available on the following websites:
Ministry of Health Malaysia: www.moh.gov.my
Academy of Medicine Malaysia: www.acadmed.org.my

CLINICAL PRACTICE GUIDELINES SECRETARIAT
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Medical Development Division, Ministry of Health Malaysia
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CASE DEFINITIONS

- 2019 Lung Injury Surveillance Primary Case Definitions by United States Centers for Disease Control and Prevention:
  - **Confirmed Case**:
    Using an e-cig ("vaping") or dabbing* in 90 days prior to symptom onset

    AND

    Pulmonary infiltrate, e.g. opacities, on plain film chest radiograph or ground-glass opacities on chest CT

    AND

    Absence of pulmonary infection on initial work-up. Minimum criteria are:
    1. A negative respiratory viral panel

    AND

    2. A negative influenza polymerase chain reaction (PCR) or rapid test, if local epidemiology supports influenza testing

    AND

    All other clinically-indicated respiratory infectious disease testing (e.g. urine antigen for *Streptococcus pneumoniae* & *Legionella*, sputum culture if productive cough, bronchoalveolar lavage culture if done, blood culture, human immunodeficiency virus-related opportunistic respiratory infections if appropriate) are negative

    AND

    No evidence in medical record of alternative plausible diagnoses (e.g. cardiac, rheumatologic, or neoplastic process).

  - **Probable Case**:
    Using an e-cig ("vaping") or dabbing* in 90 days prior to symptom onset

    AND

    Pulmonary infiltrate, e.g. opacities, on plain film chest radiograph or ground-glass opacities on chest CT

    AND

    Infection identified via culture or PCR, but clinical team** believes this infection is not the sole cause of the underlying lung injury **OR minimum criteria** to rule out pulmonary infection not met (testing not performed) & clinical team** believes infection is not the sole cause of the underlying lung injury.

    AND

    No evidence in medical record of alternative plausible diagnoses (e.g., cardiac, rheumatologic, or neoplastic process).

    Footnotes

    *Using an electronic device [e.g. electronic nicotine delivery system (ENDS), electronic cigarette, e-cig, vaporiser, vape(s), vape pen, dab pen or other device] or dabbing to inhale substances [e.g. nicotine, marijuana, THC, THC concentrates, cannabidiol (CBD), synthetic cannabinoids, flavourings or other substances]

    **Clinical team caring for the patient

    Notes: These case definitions are meant for surveillance & not clinical diagnosis. The case definitions are subject to change & will be updated as additional information becomes available if needed.

ELECTRONIC CIGARETTE OR E-CIGARETTE (E-CIG)

Inhalation of aerosol from e-cig could potentially cause:

- adverse effects due to acute administration of nicotine, flavourants, chemicals & other particulates
- accidental overdose of nicotine
- developmental effects on the brain from nicotine exposure
- uptake of subsequent illicit drug use
- gateway to conventional cigarettes & dual use of both types of cigarettes
- negative psychosocial health
- battery explosion

HISTORY OF E-CIG OR VAPING PRODUCT USE FOR PATIENTS WITH SUSPECTED EVALI

- Questions on e-cig or vaping product use in patients with suspected EVALI:
  - e-cig use
    - time of last use
    - duration
    - method (aerosol, dabbing or dripping)
    - frequency
    - concomitant smoking products use or substances abuse
  - devices & e-liquids
    - product brand name
    - delivery system (open or closed)
    - types of substances use (tetrahydrocannabinol/THC, cannabis, nicotine, modified products, additional substances)
    - product source

LABORATORY INVESTIGATION

- Laboratory investigations for EVALI work-up will include:
  - full blood count
  - erythrocyte sedimentation rate
  - C-reactive protein
  - culture & sensitivity study - blood, sputum, urine
  - urinalysis
  - respiratory panel for influenza & other possible infectious pathogens
  - autoimmune screening
- In local setting, tuberculosis & COVID-19 screening is part of EVALI work-up.

IMAGING

- Abnormal chest imaging, either chest X-ray (CXR) or computed tomography (CT) scan, is mandatory for the diagnosis of EVALI.
- While CXR is often abnormal in EVALI cases, a normal CXR does not exclude the diagnosis. In the setting of a normal CXR in a high clinical suspicion of EVALI, a CT scan should be performed to better assess for lung injury.

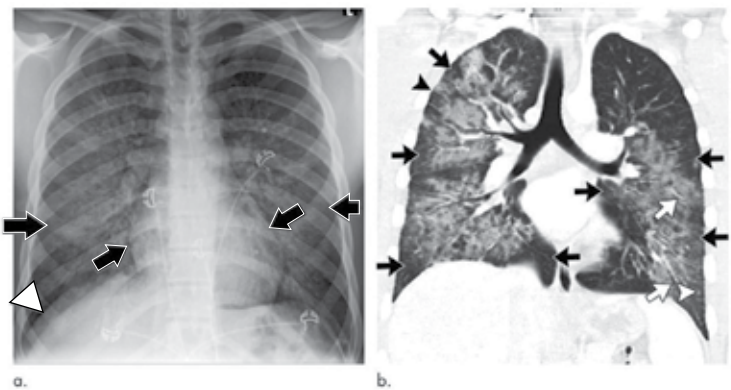

Figure I. Imaging Features in EVALI

a. Chest radiograph shows infiltrates with sparing of subpleural region (black arrows) & interlobular septal thickening (white arrowhead).
b. Corresponding CT image shows perihilar predominant ground-glass opacity with prominent sparing of subpleural interstitium both peripherally & centrally (black arrows) with intermixed areas of lobular sparing. In addition, there is sparing of peribronchovascular interstitium (white arrows). Septal thickening (black arrowhead) & scattered centrilobular nodules (white arrowhead) are present.

CHEMICAL PROFILING

- Potential toxicants in e-liquid include propylene glycol, vegetable glycerin, flavouring agents, vitamin E acetate, CBD, THC & nicotine.
- More strong evidence is warranted before proper chemical profiling can be recommended in cases of EVALI.

DIFFERENTIAL DIAGNOSIS

- Testing or empirical treatment for usual infectious pneumonia based on the probability of the illness is recommended.
- Probability of alternative diagnosis increases when either:
  - absence of typical demographic & clinical features of EVALI
  - presence of atypical presentations
  - presence of predisposition for other illness
- EVALI can be considered a leading or provisional diagnosis if none other illness is probable based on the above evaluation.

TREATMENT

- Treatment with empiric antimicrobials, including antivirals, should be considered in accordance with established local guidelines & microbiology pattern.

- Documented corticosteroids treatment in EVALI are:
  - initial daily dose for:
    - intravenous methylprednisolone is 125 mg/day (interquartile range/IQR 120 - 240)
    - oral prednisolone is 40 mg/day (IQR 40 - 60)
  - duration before tapering dose or stopping: 2 days (IQR 1 - 4)
  - total duration of therapy: 11 days (IQR 6 - 18)

*There is no evidence on the use of hydrocortisone, dexamethasone & inhaled corticosteroids in EVALI.

INDICATIONS FOR ADMISSION

- Hospital admission is highly recommended for patients with:
  - decreased oxygen saturation (<95% on room air)
  - concurrent illness especially if respiratory distress is present
  - co-morbidities that compromise pulmonary reserve
  - unreliable access to medical care especially ability for follow-up within 24 - 48 hours & promptly in the event of rapidly worsening respiratory symptoms
  - poor social support

MANAGEMENT IN EMERGENCY DEPARTMENT/PRIMARY CARE FACILITY

- Criteria appropriate for outpatient management are:
  - normal oxygen saturation ≥95% with no respiratory distress on room air
  - absence of high-risk co-morbidities e.g. chronic obstructive pulmonary disease or congestive cardiac failure
  - availability of support system for outpatient follow-up
  - no significant diagnostic findings on initial emergency department (ED) workup

DISCHARGE FROM HOSPITAL

- Criteria to determine readiness for hospital discharge include:
  - patient is clinically stable for 24 - 48 hours before discharge
  - initial outpatient follow-up within 48 hours of discharge
  - instruction on discharge medication & counselling of patient is given
  - screening for mental health, substance use disorders & social support needs is established before discharge
  - counselling & offering e-cig & tobacco use cessation intervention, including behavioural intervention & medications have been discussed

DISCHARGE HOSPITAL PRESCRIPTION

- Discharge from hospital prescription may include:
  - prescription of a short course oral corticosteroids with appropriate dosage, duration & tapering
  - prescription of an oral antibiotic or antiviral if necessary
  - follow-up at outpatient clinic within 24 - 48 hours
  - education on strict return-to-ED warnings (development of new or worsening respiratory symptoms, with or without fever)
  - provision of access to outpatient smoking & vaping cessation facility

EVALI PATIENT FOLLOW-UP CHECKLIST

The following should be done on EVALI patients on follow-up:	
Activity	**Comment**
a. At 48 hours follow-up:	
• Continue education about EVALI	
• Assess & encourage adherence with medication regimens	
• Ask about side effects of treatment	
• Reinforce the importance of abstinence from e-cig product use	
• Facilitate referrals to other providers or services indicated by patients' medical history or conditions	
• Provide relevant resources on social, mental health & substance use disorder	
b. At 1 - 2 months follow-up	
• Repeat all the steps at 48 hours follow-up	
• Do spirometry	
• Do CXR	

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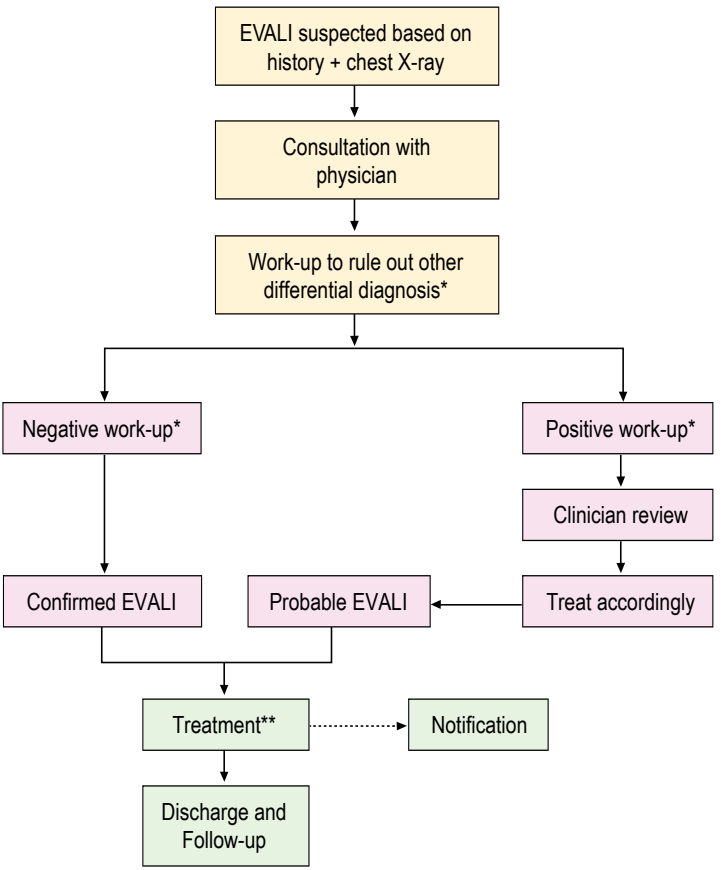

*May require admission

Refer to **Case Definitions in page 4