Public Health England

Protecting and improving the nation's health

Diagnosis and early management in organophosphate chemical incidents

6 July 2018

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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Produced July 2018
PHE publications
gateway number: 2018237

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Sustainable Development Goals

Contents

Public health messaging has not changed.

The risk remains low, but is being kept under constant review

General advice

If concerned seek advice early.

Contact the PHE Emergency Response Department (ERD) on 0300 303 3493 to access the Emergency Co-ordination of Scientific Advice (ECOSA) Service.

Recognising the release of a chemical

Visual indicators of a chemical event may include all or some of the following:

- step 1, 2, 3 plus triggers
- dead or distressed people and animals
- individuals showing unexplained signs of skin, eye or airway irritation, breathing difficulties, nausea, vomiting, sweating, blurred painful vision, disorientation, fitting or unconsciousness
- the obvious presence of hazardous materials (smell, taste or appearance) or unusual materials/equipment
- unexplained vapour, mist clouds, oily droplets or films on surfaces or water

Clinical symptoms that may be associated with nerve agent (organophosphate poisons):

- nausea and vomiting
- headache
- disordered mental state
- blurred/painful vision
- involuntary faecal incontinence

Clinical response

Clinical response if you know, or strongly suspect, that your patient has been involved in a chemical incident:

- use the Initial Operational Response (IOR) method to co-ordinate emergency service actions. See: https://www.england.nhs.uk/ourwork/eprr/hm/#ior
- ensure that you are wearing appropriate personal protective equipment (PPE)
- decontaminate the patient if needed and if this has not already been done (at scene, or outside accident and emergency department in designated NHS decontamination facilities/decontamination area)
- stabilise using standard guidelines (eg ABCDEs):
  - airway (stabilise using standard guidelines (ABCs)) - supraglottic airways such as iGel preferred to intubation
  - breathing (high flow rate oxygen by mask; ventilate if needed)
  - control any haemorrhage, set up IV access and provide fluid resuscitation if needed

Seek expert advice from PHE ERD ECOSA Service on 0300 303 3493.

Public health response

Public health response if you know, or strongly suspect, that your patient has been involved in a chemical incident:

- assess the plausibility/credibility that a chemical agent has been used
- determine the immediate primary public health countermeasures – especially the need for shelter or evacuation
- work with joint command structures to provide advice on safety of the public, specific public protection and clinical public health countermeasures that are likely to be required
- the guideline ‘evaluating rapidly evolving chemical exposure syndromes’ may help to support your actions
- determine whether decontamination is needed and give advice on urgency and method – note that decontamination IS NOT REQUIRED for exposure to a gas

Nerve agent (organophosphate poisons)

Summary:

- HIGHLY TOXIC chemical warfare agents: small drop on skin can be FATAL
- cause death by RESPIRATORY ARREST due to CNS depression and
- muscle paralysis by same mechanism as organophosphorus insecticides
- absorbed through skin (through clothing) and eyes, by inhalation, or by ingestion
- RAPID DRY DECONTAMINATION is essential following SKIN EXPOSURE; secondary cases can follow exposure to inadequately decontaminated primary cases
- clinical effects depend on agent, on dose, duration and route of exposure
- local effects are immediate

SPECIFIC ANTIDOTES ARE AVAILABLE AND CAN BE LIFE SAVING IF ADMINISTERED PROMPTLY.

Seek expert advice from the PHE ERD ECOSA Service on 0300 303 3493.

Always treat as a deliberate release.

Effects of exposure

Acute effects of exposure:

- increased salivation, chest tightness, rhinorrhoea, bronchorrhoea and/or bronchospasm can occur within seconds or minutes of substantial inhalation of a nerve agent
- pupils: miosis due to muscarinic effects, which may be painful and last for several days, occurs rapidly following ocular exposure to a nerve agent. It is a sensitive marker of exposure but not of severity; beware that mydriasis may be present where nicotinic effects predominate – best clinical summary is therefore presence of painful blurred vision with either miosis or mydriasis
- skin contact with a nerve agent may produce localised sweating and fasciculation, which may spread to involve whole muscle groups
- ingestion of food or water contaminated with nerve agents may cause abdominal pain, nausea, vomiting, diarrhoea, involuntary defecation
- all routes of exposure may result in systemic effects, including abdominal pain, nausea and vomiting, involuntary micturition and defecation, muscle weakness and fasciculation, tremor, restlessness, ataxia, coma and convulsions; bradycardia and

hypotension, or tachycardia and hypertension, may occur, depending on whether muscarinic or nicotinic effects predominate; dysrhythmias may occur
if exposure is substantial, death will occur from respiratory failure within minutes unless antidotes and ventilatory support are provided – individuals with mild or moderate exposure usually recover completely

- late complications of poisoning may result from aspiration or hypoxic brain injury from early loss of consciousness and respiratory failure

Management

Management:

- ensure that you are wearing appropriate PPE
- maintain airway, give supplemental oxygen, suction secretions
- remove patient's clothing if not already done (double bag, seal, label, and store securely)
- for severe or moderate symptoms, establish IV access, arrange assessment by anaesthetist
- if the patient develops increased secretions, rhinorrhoea, bradycardia, hypotension, bronchorrhoea, and/or bronchospasm, administer atropine urgently
- give pralidoxime, when effect atropinisation has been achieved
- control frequent or prolonged convulsions with diazepam, lorazepam or midazolam
- intubate and ventilate if apnoeic or severe respiratory distress (avoid succinyl choline)
- check ABGs, U&Es, glucose; monitor ECG, treat arrhythmias
- paralysis may mask seizures – consider EEG monitoring
- progression of symptoms suggests inadequate treatment; seek expert advice from the PHE ERD ECOSA Service on 0300 303 3493 regarding dose regimes

ATROPINE: may be given IV / IM / IO
Adults and children aged 12 years or over: 4.0 - 4.2 milligrams (8 x 500 / 7 x 600 microgram ampoules)
Children (under 12 years of age): 50 to 75 microgram/kg in a child
Doses repeated every five minutes until secretions are minimal and the patient is 'atropinised' (lungs are clear, heart rate is greater than 80/min, and blood pressure is adequate)
Note: as the pupils may remain constricted/dilated for several days due to direct nerve agent exposure, pupil size should not be used as an end point for atropinisation

PRALIDOXIME: give IV / doses are for all ages
Initial loading dose: pralidoxime chloride 30 mg/kg body weight (about 2g in an adult) over 30 minutes to reactivate inhibited AChE
Continuation treatment: infusion at 8mg/kg/hour (about 0.5g/hour in an adult) – continue the infusion for 12 to 24 hours; on withdrawal, if there is deterioration, restart the pralidoxime infusion

BENZODIAZEPINES FOR CONTROL OF CONVULSIONS: IV doses

diazepam	10 to 20mg in adults; 0.1 to 0.3mg/kg body weight in children
lorazepam	4mg in adults; 0.1mg/kg in children
midazolam	5 to 10mg in adults; 0.05 to 0.15mg/kg in children

See also: emergency contacts, decontamination, personal protective equipment, diagnosis and early management of chemical incidents, PHE Compendium of Chemical Hazards, TOXBASE

Incident management records

Overview:

- many, if not all, major incidents, accidents or outbreaks will be followed by an investigation, it is therefore very important that your records are comprehensive, contemporary and legible
- incident management records should include the details of ALL advice given or received, and ALL actions taken to protect yourself, staff, patients or the public, or to inform others
- all records must be timed, dated and signed, preferably in a perfect bound log book with numbered pages. Records should be contemporaneous and any corrections or amendments made according to accepted best practice directions
- you may find the following form, which may be freely copied, helpful – it may not cover everything, so amend it as necessary

Incident advice form			
Unit:	Department:	Date:	
Type of incident	Place of incident	No. of casualties	

Task	Advice received or action taken (sign, date, time)	Source of advice (name, date, time)	Contact details
Staff protection/PPE and safe system of working			
Security of site			
Air conditioning system actions			
Patient containment/ contact tracing			
Decontamination			
Clinical investigations			
Post-exposure treatment			
Environmental sampling			
Who informed?			

Chain of evidence documentation

Overview:

- if a deliberate release is suspected or there are other forensic considerations, chain of evidence (sometimes called ‘chain of custody’) documentation will be needed for samples
- chain of evidence forms are intended to provide a complete record of the ‘life’ of a sample – from obtaining the sample, through testing (perhaps in two or three different laboratories), to storage
- any break in the chain of documentation may compromise the evidential value of the sample
- samples from a single patient to a single destination (eg microbiology, toxicology laboratory) can be grouped together on the same form
- every transfer of a sample must be documented. If you use the form below, which may be freely copied or used as a template for your own form, you will need to complete a new form for each transfer (eg from the person who took the sample to the porter who will take the sample to the laboratory; from porter to scientist; from laboratory to courier service; from courier service to scientist in reference laboratory). All the forms in this chain must be numbered in sequence
- keep all the forms for one set of samples together – and keep the originals carefully: photocopies cannot usually be used as evidence
- the consultant in charge of the case should authorise the transfer of the sample(s) to the laboratory. To prevent delay, particularly for specimens critical to patient care (eg group and save, cross-match, ABGs), authorisation may be given verbally – but the consultant must sign the form as soon as practicable thereafter
- the pro-forma below is illustrative and can be used as a template for the unit. It can be used as an Adobe form format. The chain of evidence form needs to link to any specimens taken

Chain of evidence record				
Hospital/trust				
Patient details	Patient name:		Sex:	Date of birth:
	Hospital number:	Postcode:		Ward/Department:
Requesting doctor:		Bleep/Extension number:		Consultant:
Sample details				
Sample type/description		Sample date	Sample time	Laboratory/specimen number
Handover details				
Person handing over the sample(s)			Person receiving the sample(s)	
Name:	Grade:		Name:	Grade:
Signature:	Date and time:		Signature:	Date and time:
Person authorising the transfer				
Name:		Signature:		Date:
Address:				Form number: