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A convenient first aid kit for chemical and biological agents and for radiation exposure

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Abstract

The chemical and biological warfare agents are extremely toxic in nature. They act rapidly even in very small quantities and death may occur in minutes. Hence, physical and medical protection must be provided immediately to save life or avoid serious injury. A first aid kit has thus been developed for providing immediate relief from chemical and biological warfare agents (FAKCBW) with the objective of easy detection, personal decontamination, antidote for chemical warfare agents (like nerve agents, sulphur mustard, phosgene, cyanide, radiation exposure and bacterial agents), along with basic medication aid for pain, fever and inflammation. The kit box also includes a user friendly handbook with a simple standard operating procedure. In addition, the kit is rugged to withstand normal jerks, vibration and is water-proof.

Key words

First aid kit, Chemical warfare agent, Biological warfare agents, Medical protection

Introduction

Production of chemical and biological weapon is a cheap and easy option for any hostile country or radical groups of any size and economy. The efficacy of these agents to produce large number of causalities and fear factor make these an appropriate choice for anti-peace elements and terrorist groups. Such extremely toxic chemicals can be a potential source of hazard, and can be used to kill or incapacitate humans during war and by terrorists (Marrs, 1996). Use of such warfare agents is not hypothetical rather long been known since history till date. Since World War I, there are several reports available of the use of such toxic chemicals

(Newmark, 2004). Huge quantities are also stockpiled and they are in the process of destruction. The armed forces and the civilians are under a constant threat from a variety of toxic chemicals that can be used as weapons of mass destruction (Vale, 2005).

Other than the toxic chemicals, pathogenic microorganisms can also be used as weapons of mass destruction (Greenfield *et al.,* 2002; Ramasamy *et al.,* 2010). Such microorganisms are a constant threat to humans, and its spread can be attempted by enemy forces and by terrorists. Estimation of their potential hazard is well described by 1970 World Health Organization (WHO) publication (Geissler, 1986). It is estimated that for example if 50 kg of aerosolized *Bacillus anthracis* spores are dispersed by an airplane 2 km upwind of a population of 500 000 unprotected people in an ideal meteorological condition would travel more than 20 km and kill or incapacitate up to 220 000 people. Biological warfare agents may include the use of bacteria, viruses or toxins (of microbial, plant, or animal origin). Microbes like *Bacillus anthracis*, *Clostridium botulinum, yersinia pestis* (plague), *Staphylococcal* spp (SEB), and *Venezuelan equine encephalitis* (VEE) virus are potential biological warfare agents (Franz *et al.,* 1997). However, efficacy of biological warfare agents are limited to ideal environmental conditions and their incubation time required for development of disease render them incapable of immediate effect (Jernigan *et al.,* 2001). On the other hand, chemical warfare agents are extremely toxic that act in very small quantities with rapid action on the exposed population. The most popular include the nerve and blood agents (Somani, 1992). Some of them like the blistering agents, though may not cause immediate lethality, but are highly incapacitating (Vijayaraghavan *et al.,* 2009). Hence, immediate aid, in terms of physical as well as medical protection is needed in such scenario. Due to its sudden nature and rapid action it may not be possible to evacuate the exposed casualties to the treatment posts immediately. Hence, on-field detection and medical protection has to be readily available to the exposed soldiers as first aid, either for self administration or by the companion. The first aid kit may be of different types and the composition may vary depending upon the requirement and type of medical cover planned. There is always a need for inclusion of effective drugs with quick administration.

The aim of the present investigation is to develop a rough and tough first aid kit for chemical and biological warfare agents (FAKCBW): Easy detection, Personal decontamination, Antidote for nerve agents, Antidote for sulphur mustard and phosgene, Antidote for cyanide, Antidote for radiation exposure, Antidote for bacterial agents, Antidote for pain, fever and inflammation and User handbook with a simple standard operating procedure.

Materials and Methods

FAKCBW : It is made of a polypropylene box with the dimensions of 350mm x 165mm x 150mm and 4 mm thickness. It has partitions for each medicine (SKM Design, New Delhi). The total weight of the FAKCBW with all the medicines is about 2.4 kg (Fig. 1). FAK CBW kit is made of injection moulded polypropylene, colored in olive green. Small boxes for housing eye drops and ointments have also been made in injection moulded random transparent polypropylene. The kit PDK-1 is a cotton cloth pad filled with adsorbent material. The pads are packed in polythene laminated aluminum foil pouch having instructions printed, with a notch at one corner for easy tearing in order take out the pads for use. The PDK-2 is a polythene puffer bottle having adsorbent material same as in PDK-1. The PDK (CC2) is a polythene puffer bottle having suspension of N, N- dichloro-bis [2, 4, 6 trichlorophenyl] urea, methyl cellulose, betaine and *Aloe vera* gel. The RDP are detergent soaked wet napkins of tissue paper packed in polythene laminated aluminum foil pouch having inscription for use.

Contents : The FAKCBW contains all emergency medicines required for treating chemical and biological warfare agents. It contains detector paper, personal decontaminants, antidotes and supportive drugs for bhemical, biological and radiation exposure as medical countermeasures. The list of the items is given in Table 1.

Standard operating procedure : The FAKCBW is intended for field treatment and hence should be simple to use by the individual. Starting from the detection of the toxic agent, personal decontamination and drug treatment, the usage of the FAKCBW has been simplified with colour coding of the items viz., yellow for detection and decontamination, green for sulphur mustard, and red for bacterial agent treatment. Blue stands for immediate attention (nerve gas, cyanide or radiation exposures), as in this cases these antidotes have to be administered at once (Fig. 2).

Fig.1 : Three dimensional image of first aid kit containing constituents for detection, decontamination and antidotes for chemical, biological and radiation exposure

Table 1 : A tabular chart (part of first aid kit) enlisting various constituents for their identification and description of their intended therapeutic application

Group	No.	Medicines/item	Qty	Remarks
Detection	1	Three colour detector paper for chemical agent	1 book	For detection of G, V and H agents.
Physical protection	2	PDK-1 pouch, PDK-2 bottle, PDK(CC2) bottle, RDP pouch	4,1,1,2 Nos	Use PDK-1 or PDK-2 followed by PDK(CC2) and RDP for complete decontamination.
Antidote for nerve agent	3	Reusable Autoject injectors; Atropine sulphate and PAM chloride.	3 pairs	For nerve agent exposure; both autoinjectors are important and among them atropine sulphate is very important, and hence to be administered first.
	4	Pyridostigmine tablets 30 mg	20 tabs	As a prophylactic agent for nerve agent exposure.
Antidote for sulphur	5	N-Acetyl cysteine – 600 mg	20 tabs	As a supportive drug for respiratory problems including sulphur mustard and phosgene exposures.
mustard	6	Mupirocin skin ointment 5 g	2 tubes	For wounds and infection including sulphur mustard wounds.
and	7	Povidone iodine skin ointment 15 g	1 tube	For wounds and infection including sulphur mustard wounds.
phosgene	8	Codeine phosphate(10 mg) or sulphate (15 mg)	40 tabs	As antitussive for cough due to sulphur mustard and phosgene exposure.
	9	Beclomethasone inhaler 100 mcg/puff	1 inhaler	For phosgene exposure and other respiratory disorders.
	10	Ciprofloxacin eye/ear drops	7 btls	For eye infections and eye injuries due to chemical agents.
Antidote for cyanide	11	Amyl nitrite inhalant (0.3 ml)	36 ampls	Inhalant treatment drug for cyanide exposure.
Antidote for radiation	12	Potassium iodate tablets – 85 mg	20 tabs	For radiation protection from radioactive iodine (131).
Antibiotic for bacterial agents	13	Doxycycline capsules – 100 mg	30 tabs	Effective antibiotic for bacterial agents.
For pain relief	14	Paracetamol 325/500 mg & Ibuprophen 400 mg	30 tabs	Effective antipyretic, analgesic and anti-inflammatory drug.
Wound dressing	15	Sterile gauze dressing (10x5 cm)	3 pads	For dressing open wounds.

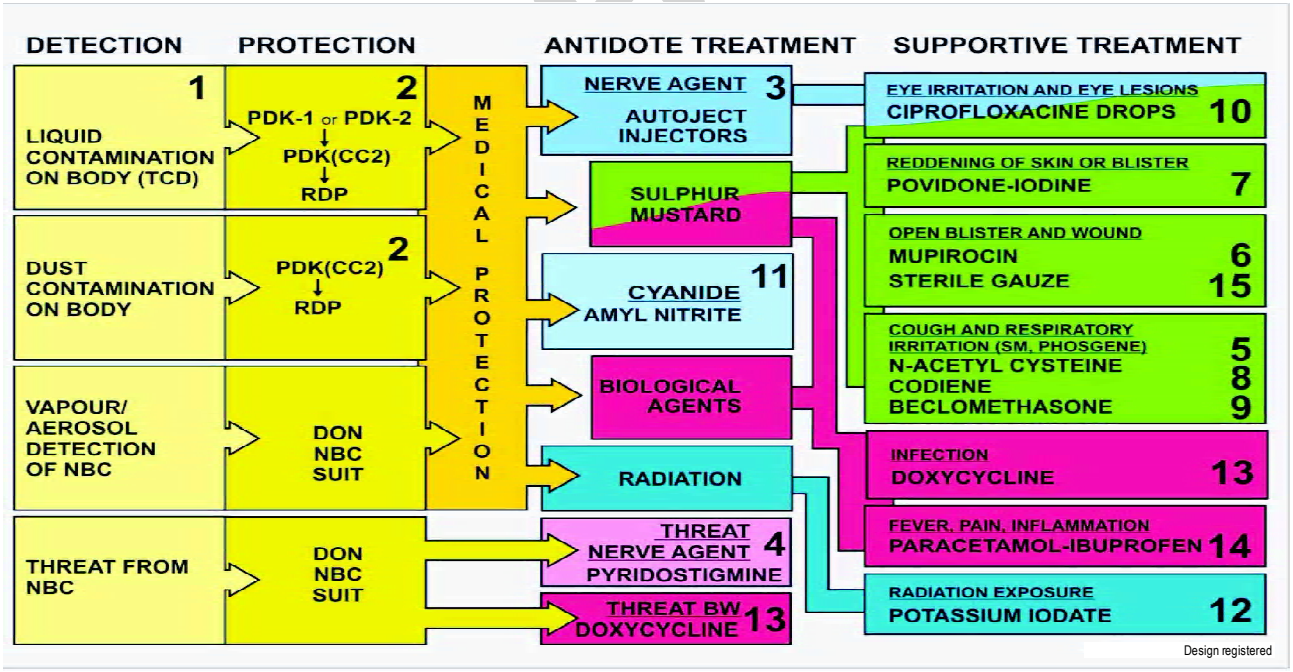

Fig.2 : A flowchart as Standard Operating Principale (SOP) depicting various constituents of first and kit and the direction for their respective use in an appropriate situation represented in a color code scheme

Results and Discussion

A. Specialized items in FAK-CBW:

1. Detector paper chemical agents– three colour detector paper

Use in FAK CBW : For the identification of nerve agents and sulphur mustard (Ganesan *et al.,* 2010).

Other uses : For the identification of nerve agents and sulphur mustard in vapour or liquid form.

Action: Three-colour detector (TCD) paper is used for detection for liquid blister and nerve agents. The detector paper works on dissolution principal, as different agents dissolve different dyes and gives its respective colour. It contains a specific dye mixture impregnated paper possessing water repellency. Bromophenol blue, tulastron fast red BC, and tulastron fast yellow 2 GB dyes were mixed thoroughly along with water repellent chemicals and were impregnated on filter paper. VX dissolves bromophenol blue present on the paper and gives green to grey colour. Sulphur mustard dissolves tulastron fast red BC and gives pink to red colour on the paper. Whereas, sarin or soman dissolves tulastron fast 2 GB yellow and gives yellow to orange colour. The paper sticks to any surface and produces three distinct colours when comes in contact with blister and nerve agents. TCD paper booklet comprises of 10 leaflets and easy tearing arrangement. The paper is protected with a plastic cover and can be used under a wide range of temperature and humidity. It has a weight of 25 g and shelf life of 2-3 years.

Method

- Peel off detector paper from the booklet.
- Attach the adhesive side to the marked surface.
- Expose to the environment or suspected vapour
  Look for color change
  Red = Sulphur mustard
  Yellow = G agent (e.g. tabun, sarin and soman)
  Purple = V agent (e.g. Vx)
- For suspected liquids, place a drop on the detector paper
  Look for the colour change
  Red = Sulphur mustard
  Yellow = G agent (e.g. tabun, sarin and soman)
  Purple = V agent (e.g. Vx)

Source : DRDO (DRDE) technology holders.

2. Personal decontamaination kit and radiation decontamination paper :

PDK-1, PDK-2, PDK (CC2) and RDP

Use in FAK CBW: Physical and chemical decontamination of chemical and biological warfare agents and physical removal of radioactive particles (Chilcott *et al.,* 2001; Vijayaraghavan *et al.,* 2001).

Other uses: As a multipurpose decontamination agent for toxic chemicals and microbes.

Chemical name : PDK-1 and PDK-2 are Fuller's earth; PDK (CC2) is N,N'- dichloro-bis (2,4,6) trichlorophenyl urea; RDP is surfactant soaked napkins.

Action: The sequence of decontamination is PDK-1 followed by PDK-2; followed by PDK(CC2) and then RDP wipe. Fuller's earth will physically remove the chemical and biological agents due to its adsorptive effect and CC2 will oxidize them. The surfactant soaked napkin will wipe all the liquid and solid matter (Fig. 3).

Side effects : None

Usage : Liberal application of PDK-1 or PDK-2 followed by PDK (CC2) and then RDP wipe.

Source : DRDO (DRDE) technology holders.

3. Description of reusable Autoject injectors (AJI)

Use in FAK CBW : Atropine sulphate and Pralidoxime chloride Autoject injectors are antidotes to nerve agent poisoning (Friedl *et al.,* 1989; Henretig *et al.,* 2002; Vijayaraghavan *et al.,* 2007).

Fig.3 : A pictorial representation of standard operating procédure (SOP) for physical and chemical decontamination of chemical, biological warfare and radioactive particles

Other uses : Atropine sulphate and Pralidoxime chloride autoject injectors can be used in organophosphorus insecticide poisoning. Atropine sulphate autoject injector can also be used in carbamate insecticide poisoning.

Chemical name : Atropine sulphate: 1± H, 5± H-Tropan-3-± ol (±)-tropate (ester), sulphate monohydrate. Pralidoxime chloride : 2-formyl-1 methylpyridinium chloride oxime

Action : The nerve agents inhibit the enzyme acetylcholinesterase irreversibly, which is responsible for hydrolyzing the neurotransmitter, acetylcholine. As a result of this, there will be accumulation of acetylcholine and the effects are due to its action on the muscarinic and nicotinic receptors. Exposure to high concentrations may cause death in minutes. The organophosphorus insecticides also cause similar symptoms and death may occur at high doses. The immediate measures are to stop further exposure by removing the individual from the contaminated environment or by donning protective gears. Artificial respiration may be required if the individual is unconscious. The principle of nerve agent treatment is by: (1) to antagonize the excess actions of acetylcholine with atropine sulphate and (2) reactivate the inhibited enzyme acetylcholinesterase with pralidoxime chloride (Holstege *et al.,* 1997). Atropine sulphate is a competitive inhibitor of acetylcholine and acts mainly on the parasympathetic muscarinic receptors. Atropine sulphate blocks only the muscarinic effects and it has no action on the nicotinic effects of acetylcholine viz., muscular weakness and paralysis of the respiratory muscles. These effects can be relieved by reactivating the inhibited acetylcholinesterase by oximes like pralidoxime chloride. The two drugs are included in the kit for parenteral administration (intramuscular injection). For the treatment of nerve agent poisoning both the drugs are essential.

Side effects : In the absence of nerve agent exposure, if atropine sulphate is injected the following adverse effect will appear : Dryness of mouth, dryness of skin, constipation, tachycardia, palpitation, mydriasis, hyperpyrexia, hallucinations and delirium. In the absence of nerve agent exposure, if pralidoxime is given the following adverse effects will appear: drowsiness, dizziness, visual disturbances, nausea, tachycardia, headache, muscle weakness and hyperventilation. None of these effects are serious if accidentally or unknowingly administered.

Dosage : Atropine sulphate 2 mg and pralidoxime chloride 600 mg and should be repeated after 15 min, if nerve agent poisoning persists (Fig. 4).

Drug example: DRDO (DRDE) technology holders of autoject injector device and drug cartridges.

B. Description of other medicine in FAK-CBW

4. Pyridostigmine bromide tablets use in FAK CBW: It is used as a prophylactic drug for nerve agents poisoning (Vijayaraghavan *et al.,* 1992; Layish *et al.,* 2005).

Other uses: Pyridostigmine is used to treat the symptoms of myasthenia gravis (Sieb *et al.,* 2010).

Chemical name: 3-hydroxy-1-methylpyridinium bromide dimethylcarbamate

Action: Pyridostigmine is an orally active cholinesterase inhibitor. The carbamate compounds are reversible cholinesterase inhibitors and are known to offer protection against irreversible cholinesterase inhibitors like the organophosphorus nerve agents. A 30 to 40 % inhibition of the cholinesterase by the reversible cholinesterase compounds offers better protection against the organophosphorus compounds.

Side effects: The side effects are most commonly related to over dosage and generally are of two varieties, muscarinic and nicotinic. Among those in the former group are nausea, vomiting, diarrhea, abdominal cramps, increased peristalsis, increased salivation, increased bronchial secretions, miosis and diaphoresis. Nicotinic side effects are chiefly muscle cramps, fasciculation and weakness.

Dosage: The recommended dosage is 30 mg, 8 hourly, orally. This dose is expected to offer about 30 to 40 % of cholinesterase inhibition.

Drug example: It is a generic drug.

5. N-Acetyl cysteine tablet

Use in FAK CBW: As a mucolytic agent and also due to its glutathione sparing effect, it will be a supportive drug in sulphur mustard and phosgene exposures (Sciuto *et al.,* 1995; Bobb *et al.,* 2005; Ghanei *et al.,* 2008; Grainge and Rice, 2010).

Other uses: As a mucolytic agent in cough and cold preparations, and paracetamol poisoning (Yarema *et al.,* 2009).

Chemical name: N-acetyl derivative of the amino acid L-cysteine.

Action: The mucolytic action of acetylcysteine is related to the sulfhydryl group in the molecule. This group probably opens disulfide

Fig.4 : A pictorial representation of standard operating procedure (SOP) for atropine sulphate and pralidoxime chloride autoject injectors.

linkages in mucous thereby lowering the viscosity. Some toxic chemicals and their reactive metabolites may deplete the hepatic stores of glutathione with subsequent binding of the metabolite to protein molecules within the hepatocyte resulting in cellular necrosis. Acetylcysteine has been shown to reduce the extent of liver injury following paracetamol overdose. Its effectiveness depends on early oral administration. Acetylcysteine probably protects the liver by maintaining or restoring the glutathione levels. It can also act as an alternate substrate for conjugation with reactive metabolites and detoxify them.

Side effects: Adverse effects are stomatitis, nausea, vomiting, fever, rhinorrhea, drowsiness, chest tightness and broncho-constriction.

Dosage: 600 mg three times a day.

Drug example: It is a generic drug.

6. Mupirocin skin ointment use in FAK CBW: As a topical antibiotic for sulphur mustard wounds (Acikel *et al.,* 2003; Sheth and Weitzul, 2008).

Other use: As a topical antibiotic for skin infections, cuts and wounds. Also used to treat impetigo (Leyden, 1992).

Chemical name: 9-[(E)-4-[(2S,3R,4R,5S)-3,4-dihydroxy-5-[[(2S,3S)-3- [(2S,3S)-3- hydroxybutan-2-yl]oxiran-2-yl]methyl] oxan-2-yl]-3-methylbut-2-enoyl] oxynonanoic acid

Action: Mupirocin is a naturally occurring antibiotic effective against bacterial infections and not against fungal or viral infections. It is bacteriostatic at low concentrations and bactericidal at high concentrations. Mupirocin has been shown to strongly inhibit protein and RNA synthesis. DNA and cell wall formation were also affected to a lesser degree.

Side effects: Erythema and dryness of skin may rarely occur

Dosage: Liberal application of the ointment.

Drug example: It is a generic drug.

7. Povidone Iodine skin ointment use in FAK CBW: To treat erythema and wound of sulphur mustard (Wormser et al, 1997).

Other uses: As a topical antiseptic (Wormser *et al.,* 2000; Lomesh *et al.,* 2011).

Chemical name: 2-Pyrrolidinone, 1-ethenyl-, homopolymer, compound with iodine.

Action: Povidone-iodine is a stable chemical complex of polyvinylpyrrolidone (povidone) and elemental iodine. The ointment contains 5 % povidone-iodine that provides 0.5 % free iodine. Free iodine, slowly liberated from the poviodine-iodine complex in solution, kills eukaryotic or prokaryotic cells through iodination of lipids and oxidation of cytoplasmic and membrane compounds. This agent exhibits a broad range of microbicidal activity against bacteria, fungi, yeast, protozoa and viruses. Slow release of iodine from the povidone-iodine complex in solution minimizes iodine toxicity towards mammalian cells. The free iodine has antibacterial, antifungal, antiviral and antiprotozoan properties.

Side effects: Allergy and hypersensitivity may occur.

Dosage: Liberal application.

Drug example: It is a generic drug.

8. Codiene phosphate or sulphate tablet use in FAK CBW: As a cough suppressant in the case of sulphur mustard and phosgene exposure (Dhiller, 1985; Ghanei *et al.,* 2006; Bast and Glass, 2009).

Other uses: Used in cold preparations and also used as an analgesic to treat mild to moderate pain.

Chemical name: Codeine Sulfate is Morphinan-6-ol, 7,8-didehydro-4,5-epoxy- 3-methoxy-17-methyl-(5a,6a)-sulfate (2:1) (salt), trihydrate and Codeine Phosphate as Morphinan-6-ol, 7,8-didehydro-4,5-epoxy-3-methoxy-17-methyl-(5a,6a)- phosphate (1:1) (salt), hemihydrate.

Action: Codeine acts as a narcotic analgesic. Codeine is a central nervous system depressant and directly acts on the cough centre.

Side effects: The most frequently observed adverse reactions include lightheadedness, dizziness, sedation, weakness, disorientation, visual disturbances, nausea, vomiting, and sweating. The gastrointestinal side effects include, dry mouth, anorexia, constipation, and biliary tract spasm. The cardiovascular side effects are, flushing of the face, bradycardia, palpitation, faintness, and syncope.

Dosage: Codeine phosphate 10 mg, codeine sulphate 15 mg.

Drug example: It is a generic drug.

9. Beclomethasone inhaler use in FAK CBW: For sulphur mustard and phosgene induced respiratory disorders (Dhiller, 1985; Ghanei *et al.,* 2007).

Other uses: Also used as antiasthmatic and for chronic obstructive pulmonary disorders. It is also used in allergic and non-allergic rhinitis.

Chemical name: (8S,9R,10S,11S,13S,14S,16S,17R)-9-chloro-11,17-dihydroxy- 17-(2-hydroxyacetyl)-10,13,16-trimethyl-6,7,8,11,12,14,15,16- octahydrocyclopenta[a]phenanthren-3-one

Action: Beclomethasone is an anti-inflammatory corticosteroid. The corticosteroids cross cell membranes and bind with high affinity to specific cytoplasmic receptors. The result includes inhibition of leukocyte infiltration at the site of inflammation, interference in the function of mediators of inflammatory response, suppression of humoral immune responses, and reduction in edema or scar tissue.

Side effects: Beclomethasone may cause side effects such as dry or irritated throat and mouth, cough, difficult or painful speech, skin rash, increased difficulty breathing, swollen face, lower legs, or ankles, vision problems and muscle weakness.

Dosage : 100 microgram (one actuation) twice daily through mouth (Fig. 5)

Fig.5 : A pictorial representation of standard operating procedure (SOP) for the use of beclomethasone for sulphur mustard and phosgene induced respiratory disorders

Drug example : It is a generic drug.

10. Ciprofloxacin eye/ear drops use in FAK CBW: As a protective antibiotic for eye lesions induced by chemical agents (Yolton, 1992; Adenis et al, 1996; Snyder-Perlmutter *et al.*, 2000).

Other uses : Ciprofloxacin ophthalmic solution is indicated for the treatment of corneal ulcers and conjunctivitis. It is also indicated for the treatment of otitis externa, acute otitis media, chronic suppurative otitis media.

Chemical name: 1-cyclopropyl- 6-fluoro- 4-oxo- 7-piperazin- 1-yl- quinoline- 3- carboxylic acid

Action: Ciprofloxacin is a synthetic chemotherapeutic antibiotic of the fluoroquinolone drug class. It is the most potent first generation fluoroquinolone active against a broad range of bacteria. Ciprofloxacin is a broad-spectrum antibiotic that is active against both Gram-positive and Gram-negative bacteria. It functions by inhibiting DNA gyrase, a type II topoisomerase, and topoisomerase IV, enzymes necessary to separate bacterial DNA, thereby inhibiting cell division.

Side effects : The most frequently reported drug related adverse reaction was local burning or discomfort. In frequent administration of the drug, white crystalline precipitates may occur. Other reactions are margin crusting, crystals/scales, foreign body sensation, itching, conjunctival hyperemia and a bad taste following instillation.

Dosage : Ciprofloxacin 0.3 % eye/ear drops. Instill 1 or 2 drops every 2 hrs.

Drug example : It is a generic drug.

11. Amyl nitrite inhalant ampules

Use in FAK CBW : As an antidote for cyanide poisoning (Wurzburg 1996; Gracia and Shepherd, 2004).

Other uses: Coronary vasodilator in the treatment of angina pectoris (Nossaman *et al.,* 2010).

Chemical name: Amyl nitrite or Isoamyl nitrite

Action: Amyl nitrite causes the formation of methemoglobin, which combines with cyanide to form non-toxic cyanmethemoglobin. Amyl nitrite relaxes vascular smooth muscles resulting in generalized vasodilatation, which is required in angina pectoris.

Side effects: Increased heart beat and pulse, headache, flushed face, restlessness, dizziness.

Dosage: Take out the glass ampoule (0.3 ml) and cover it with a gauze or cloth. Break the ampoule with the fingers. Inhale the vapours. Remain seated while inhaling. Repeat it if required, after 5 minutes with a fresh ampoule (Fig. 6).

Drug example: It is a generic drug.

12. Potassium iodate tablets

Use in FAK CBW : To protect the thyroid from radioactive iodine (Astbury *et al.,* 1999; Frankfort *et al.,* 2003; Franic, 1999).

Other uses: Potassium iodate is the ingredient added to the table salt to make it iodised salt.

Chemical name : KIO_3; it contains about 76.5 % iodine.

Action : Radioactive iodine (131I) is a major constituent of detonated nuclear weapons. Accidents occurring in nuclear power facilities also release radioactive iodine. The radioactive iodine can travel hundreds of kilometers and when inhaled will affect the thyroid causing cancers and other diseases. Timely intake of potassium iodate saturates the thyroid and will prevent the absorption of radioactive iodine and the later will get eliminated by the kidneys. However, there is no medicine that will effectively prevent other nuclear radiations that will damage the human body cells.

Side effects: Some individuals are allergic/hypersensitive to iodide or to organic preparations containing iodine. Hypersensitivity reactions may involve rash, angioedema (throat swelling), cutaneous/ mucosal hemorrhage, fever, arthralgias, eosinophilia, urticaria, thrombotic thrombocytopenic purpura, or severe periarteritis.

Dosage : 85 mg for 10 days

Drug example : Commonly available.

13. Doxycycline capsules

Use in FAK CBW: As a broad spectrum antibiotic for chemical and biological warfare exposure (Brook *et al.,* 2002; Inglesby *et al.,* 2002).

Other uses: Doxycycline is used to treat bacterial infections, including pneumonia and other respiratory tract infections; Lyme disease; acne; infections of skin, genital, and urinary systems; and anthrax (after inhalational exposure). It can also be used as a

Fig. 6 : A pictorial representation of standard operating procedure (SOP) for the use of amyl nitrite inhalant

prophylaxis for malaria. It is also effective against *Yersinia pestis*, Rocky Mountain spotted fever and filariasis.

Chemical name : (2Z,4S,4aR,5S,5aR,6R,12aS)-2-(amino-hydroxymethylidene)- 4-dimethylamino-5,10,11,12a-tetrahydroxy-6-methyl-4a,5,5a,6-tetrahydro-4H-tetracene-1,3,12-trione.

Action: Doxycycline is synthetic analogue of oxytetracycline and a broad-spectrum antibiotic effective against both Gram-positive and Gram-negative bacteria. It reversibly binds to the 30 S ribosomal subunits and possibly the 50S ribosomal subunit(s), blocking the binding of aminoacyl tRNA to the mRNA and inhibiting bacterial protein synthesis.

Side effects: Nausea, GI upset, glossitis, dysphagea, photosensitivity, hypersensitivity, staining of teeth, rashes, hemolytic anemia, thrombocytopenia, neutropenia, eosinophilia, superinfection and anaphylaxis.

Dosage: First day 100 mg b.i.d., and subsequently 100 mg day^{-1}.

Drug example: It is a generic drug.

14. Paracetamol-Ibuprofen tablet

Use in FAK CBW: As analgesic, antipyretic and anti-inflammatory drug for chemical and biological warfare exposure (Mehlisch *et al.*, 2010).

Other uses: For pain and inflammation associated with musculoskeletal and joint disorders.

Chemical name: Paracetamol : N-(4-hydroxyphenyl)acetamide Ibuprofen : (RS)- 2-(4-(2-methylpropyl)phenyl)propanoic acid

Action: The combination is an analgesic, antipyretic and anti-inflammatory drug.

Side effects: Dyspepsia, heart burn, GI bleeding, rash, asthmatic attacks, thrombocytopenia, drug induced ulcer, drowsiness, hepatic necrosis, renal papillary necrosis and vision disturbances.

Dosage: Ibuprofen 400 mg and paracetamol 325/500 mg tablets, 3 to 4 times daily.

Drug example: It is a generic drug.

C. Dressing material

15. Sterile gauze dressing

Use in FAK CBW: For dressing of open wounds induced by NBC agents.

Other uses: For general dressing of any wounds inflicted during operations.

Action: The sterile gauze contains absorbent material to keep the wound dry.

Source: Commonly available.

A first aid kit has thus been developed for chemical and biological warfare agents (FAKCBW) that includes, easy detection, personal decontamination, antidote for nerve agents, sulphur mustard and phosgene, cyanide, radiation exposure, bacterial agents, pain, fever and inflammation, with an user handbook containing simple standard operating procedure. The kit is rugged to withstand normal jerks, vibration and water-proof.

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