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# A Mini Review of Available Pharmacotherapy and Potential Immunotherapy for the Toxicity of 32 Mainly Encountered Substances

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**Abstract:** Massive development in technology and industry has increased the chance of harmful exposure to different substances. This review summarises the available pharmacotherapy and immunotherapy of mainly encountered substances. The common character of the chosen substances is that they have adverse effects on the humans and animals and commonly encountered in daily life. This review is based on related books and articles which have been published in the period from 1940 to 2009. In addition, it presents other evidence for the need to develop effective treatment strategies against toxic effects od these different substance toxicity and shows where the therapy is mostly needed.

**Key words:** Ricin · Amatoxin · Pharmacotherapy · Cocaine · Antibodies · Hazardous substances

## INTRODUCTION

Recently, there have ben massive developments in different industries. This has led to the huge production of different substances as products or by products used in daily applications. Many of these substances are harmful to the environment. Treatment of their toxicity becomes a must and the available options are restricted mainly to treating the symptoms not the cause of the problem.

This paper reviews the available therapy options for toxicity due to exposure to commonly encountered substances. Each one of the substances represents an example of a main group of toxins, natural or synthetic. They are arranged in alphabetical order and chosen from the main groups of toxins which are: animal venoms, bacterial toxins, hazardous chemicals, drugs of abuse, food allergens, medical drugs, metals, pesticides, plant poisons, toxic gases and warfare agents. The main criterion of all is that they cause adverse effects to the humans and animals.

Table 1 presents 32 different toxins in terms of their available treatment options and where therapy is unavailable. This review is based on related books and articles which have been published since 1940. The available pharmacotherapy options only treats the symptoms and not effective in fully treating the toxicity of any of the indicated substances. The therapy in most cases depends on gastric decontamination; airway, blood and circulation enhancement use of intravenous fluid use of; chelating agents such as EDTA; sedatives and anticonvulsants. This is supportive treatment and generally not successful in treating acute or chronic toxicity. For example, gastric decontaminant by administration of chelating agents after a toxin had been fully absorbed through the gastrointestinal tract. In addition, most of the chosen toxins have irreversible action once they bind to their receptors[1].

As a result, many studies have been conducted to develop an effective treatment and one of the promising areas is immunotherapy. This type of treatment is based on producing specific antibodies or fractions of the antibodies that can bind specific antigens and neutralise their adverse effect either by preventing the antigens from binding to their receptors in target organs or by inducing biological effect that antagonise those of the toxic substances[2]. Both types of treatment, pharmacotherapy and immunotherapy, are summarised in Table 1.

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Table 1: Available pharmacotherapy and potential immunotherapy against 32 of commanly encountered substances

| Substance name | Pharmacotherapy | Potential Immunotherapy |
|---|---|---|
| Alpha-toxin | Antibiotic and IV[1] fluid [1] | MAbs[2] [3, 4] |
| Amatoxin | ABCs[3], charcoal, thiotic acid, penicillin G and dilibinin [1] | Fab[4] [5], IgG[5] [6] and PAbs[6] [7] |
| Botulinum toxin A,B and E | Gastric decontamination, charcoal and $O_2$ [1] | PAbs for prevention not treatment [8] and MAb (against type A) [9] |
| Carbon monoxide | ABCs [1] | N/A |
| Chlorpromazine | Lidocaine [1] | N/A |
| Cocaine | ABCs and diazepam [1] | MAbs GNC92H2 [10], PAbs, Catalytic Abs [11] and TA-CD [12] |
| Crotoxin | Immobilisation, tourniquet, sucking the wound and antihistamine [1] | Antivenin PAbs [1] |
| Cyanide | Charcoal, sodium nitrate, 4-DMAP, thiosulfate, hydroxycobalamin, dicobalt EDTA and $O_2$ [1] | N/A |
| Deltamethrin | General decontamination, gastric lavage, local steroids, antihistamines, diazepam, topical vitamin E and atropine [1] | PAbs (for measurement) [13] |
| Digoxin | Charcoal, Ka and $NaHCO_3$, insulin and glucose [1] | Fab [1] |
| Enterotoxin A,B,C,D and E | Antibiotic and IV fluid [1] | Anti-IFN[7]-gamma MAbs [14] and IgG (against type B) [15] |
| Flunitrazepam | ABCs, charcoal and flumazenil [1] | PAbs (for measurement) [16] |
| Gliadin | Avoidance of the allergen and epinephrine injection [17] | Anti-IgE and IL-4[8], TNX-901 (humanized IgG1 Mabs) as Th2[9] cytokines Rs antagonists [17] |
| Heloderma toxin | Immobilisation, tourniquets, sucking the wound and antitetanus [18] | N/A [18] |
| Hydrogen cyanide | General decontamination, dicobalt-EDTA, hydroxycobalamin (synthetic B12) and $O_2$ [1] | N/A |
| Isopropanol | Charcoal [1] | N/A |
| Lindane | General decontamination, gastric lavage, charcoal, supportive treatment, lidocane and diazepam [1] | N/A |
| Lithium | ABCs, sorbitol and bowel irrigation with polyethylene glycol-electrolyte solution [1] | N/A |
| Meperidine | ABCs and charcoal [1] | PAbs (for measurement) [19] |
| Methamphetamine | Benzodiazepines, Phenobarbital, haemodialysis and IV fluid [1] | PAbs and MAbs [11] |
| Methanol | ABCs, ethanol and dialysis [1] | N/A |
| Morphine | $O_2$, naloxon, lidocane, Na bicarbonate (for dysrythmias) [20] | Recombinant scFv[10] for measurement [20] and MAb (for measurement) [21] |
| Muscarine | Gastric decontamination, charcoal, $O_2$ and atropine [22] | N/A |
| Nicotine | Reduced doses of nicotine [23] | Xenova, Cytos and Nabi vaccines [23] |
| Paraquat | Gastric lavage, charcoal, $O_2$, IV fluid and haemodialysis [24] | PAbs and MAbs named APM-1, APM-2 and APM-3 [24] |
| Phenelzine sulfate | ABCs, gastric lavage, charcoal, diazepam, nitroprusside and dantrolene (for hyperthermia) | N/A |
| Phenylcyclo-hexylpiperidine | Sensory isolation, ventilation, gastric lavage [25] + Dronobinol and benzodiazepines [1] | MAbs[26] and Fab [27] |
| Ricin | Gastric decontamination [1] and fluid therapy [28] | IgG[29], BG11-G2 [30], MAb UNIVAX 70/138 [31], IgG2a and IgA[32] |
| Sarin | Atropine, pralidoxime chloride [1] | Anti-human AChE PAbs (for measurement) [33] |
| Strychnine | Prophylactic tracheal intubation, $O_2$ and diazepam [34] | PAbs [34] |
| Tropomyosin | Epinephrine and avoidance of the allergen [17] | PAbs and MAbs (for measurement) [35, 36] |
| Warfarin | Vitamin K1 injection and blood or plasma infusion [37] | PAbs (for measurement) [37] |

(1) Intravenous (2) Monoclonal antibodies (3) Airway, blood and circulation enhancement (4) Fragment antigen binding (5) Immunoglobulins (6) Polyclonal antibodies (7) Interferon (8) Interleukin type 4 (9) T-helper cells type II (10) Single chain variable fragment

In conclusion, potential immunotherapy for the substances of interest includes 8 monoclonal antibodies (Mabs), 3 fragment antigen binding (Fabs) and polyclonal antibodies (PAbs). There are 11substances with no available antibodies for theory. In addition, 6 of the available antibodies are for quantification purposes only these are not for treatment and show cross reactivity to other similar chemicals in structure. This indicates the need for further researches to develop more specific antibody. This is important for development of effective treatment strategies against a wide range of poisons.

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