## Case Report







# Intestinal Obstruction in Acute Inhalational Toluene 2,4-Diisocyanate Gas Toxicity

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#### Abstract

<sup>1</sup>Toxicological Research Center, Clinical Toxicology Department, Loghman Hakim Hospital Poison Center, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran <sup>2</sup>Pharmacology Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran



Correspondence to Nasim Zamani, MD, Clinical Toxicology Department, Loghman Hakim Hospital Poison Center, Kamali St, South Karegar Ave, Tehran 1333431151, Iran Tel/Fax: +98-21-5542-4041 E-mail: nasim.zamani@ gmail.com Received: Apr 3, 2013 Accepted: Jun 2, 2013 The isocyanates are widely used as precursors of polyurethane products, as well as carbamate insecticides. Toluene 2,4-diisocyanate (TDI) is one of the most important commercially used isocyanates. Humans may be exposed to TDI by inhalation, ingestion, dermal and eye contact. TDI is a powerful irritant to the mucosal membranes of the gastrointestinal and respiratory tracts, eyes and the skin. Pulmonary manifestations, especially occupational asthma, are the predominant manifestations after TDI toxicity. Herein, we present intestinal obstruction as an extraordinary manifestation of acute TDI toxicity after occupational exposure. TDI toxicity may cause intestinal obstruction.

**Keywords:** Intestinal obstruction; Toluene 2,4 diisocyanate; Intestinal obstruction; General surgery; Toxicity

## Introduction

oluene 2,4-diisocyanate (TDI) is extensively used in the production of inflexible sponge, covers such as dyes and elastomers, and for the protection of cement, wood, fiberglass, steel, and aluminum.<sup>1</sup>TDI is a clear, colorless to pale-yellow liquid with a pungent odor at room temperature.<sup>2</sup>

Humans may be exposed to TDI by inhalation, ingestion, dermal or eye contact.<sup>3</sup> It is a powerful irritant to the mucosal membranes and can cause severe allergy and asthma in those with chronic exposure; even mortality due to severe asthma has previously been reported. Pulmonary manifestations are the predominant signs and symptoms of acute TDI toxicity, but patients may present with ophthalmic, dermatological, and gastrointestinal manifestations as well.<sup>3</sup> Herein, we present an extraordinary manifestation of acute TDI toxicity after occupational exposure.

### **Case Presentation**

A 16-year-old male who had been working in a sponge production factory since 18 months before, referred to our center with nausea, vomiting, periumbilical pain, fever and chills. Problems had begun six days earlier when he had inhalational exposure to TDI for two hours. Soon after the exposure, he developed abdominal pain and diarrhea. Four days later (two days before admission), he developed constipation. At presentation, the patient had an oral temperature of 36.8 °C, blood

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pressure of 100/70 mm Hg, pulse rate of 72 beats/min, and respiratory rate of 14 breaths/min. He was a known case of lymphoma and had been treated with cyclophosphamide, hydroxydaunorubicin, vincristine, and prednisolone almost six years earlier. He had also undergone an operative surgery due to gastric lymphoma. Twenty days before the exposure to TDI, his annual check-up for lymphoma was found normal.

In examination, the patient had a mild tenderness in deep palpation of the periumbilical area without radiation to other parts of the abdomen. There were no rebound tenderness and no abdominal distention. Bowel sounds had decreased. Abdominal sonography revealed that the abdomen was full of gas; he had splenomegaly and gall stones. The intestinal loops were dilated and filled with fluid, which could be due to intestinal obstruction and/or ileus. Abdominal CT showed disseminated dilatation of the intestinal loops, thickening of the ileal wall, and collapse of the distal colon reflecting a high probability of intestinal obstruction.

The patient had a mixed respiratory and metabolic alkalosis. He had mild hyponatremia (serum sodium = 131 mEq/L); other test results were within normal range.

With highly suspicious diagnosis of intestinal obstruction, the patient underwent operative surgery. In surgery, neither a mass indicating relapse of lymphoma nor severe adhesion causing obstruction was observed. However, mild adhesions due to previous surgery were noted. Enterolysis and milking of the distended loops toward the distal parts were done.

Six days later, the patient was discharged in good condition. At follow-up visit seven months later, he was completely fine.

#### **Discussion**

The isocyanates are widely used as precursors of polyurethane products, as well as carbamate insecticides. The most common occupational disease associated with TDI is asthma. Acute TDI toxicity predominantly causes pulmonary problems including chemical bronchitis, hypersensitivity pneumonitis, asthma and acute nonspecific airway disease.<sup>4</sup> Intestinal obstruction is an extraordinary manifestation of acute and/or chronic TDI toxicity.

Diagnosis of the exact cause of intestinal obstruction in our patient could be difficult due to presence of many concurrent disorders. Our patient was young with a past history of lymphoma that had been treated with chemotherapy about six years before; he had undergone surgery due to stomach lymphoma. Although any of these could be considered the etiology of intestinal obstruction, we could not find any tumors, obvious intestinal adhesions, hernias, inflammatory bowel diseases, volvulus or intussusceptions in clinical and paraclinical evaluations and during the surgery. Hypokalemia, as another possible cause of ileus, was not detected, either.

The mechanisms through which TDI exerts its toxic effects are not well understood. TDI would invoke helper T cells with subsequent increase in neutrophil influx, interleukin-8, and interferon  $\gamma$  response.<sup>5</sup> Intestinal obstruction may happen due ileus caused by the interruption in the parasympathetic nervous system function after TDI exposure.<sup>6</sup> TDI poisoning itself may affect the intestinal smooth muscle and cause decreased bowel motility.

Although we could not find a definite cause and effect relationship between TDI exposure and intestinal obstruction, since the patient's signs and symptoms had just begun after the exposure, in the

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absence of all other possible causes of intestinal obstruction, and the patient had not been on any medications for the last six years, TDI toxicity can be considered as the most probable cause of intestinal obstruction in our patient. Further studies on people exposed to TDI are needed to elucidate this possible relationship.

**Conflicts of Interest:** None declared.

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