

Case Study: Sarin poisoning of Subway Passengers in Tokyo, Japan, in March, 1995

On March 20, 1995, the Aum Shrin Kyo began a new phase in terrorism by releasing the highly toxic chemical agent, sarin, on the [Tokyo subway system](#) during the morning rush hour. Although highly toxic, the number of casualties associated with the Tokyo subway gassing was far lower than those normally associated with sarin due to the inefficient release methods used. However, due to the lack of preparation in the event of a nerve agent release, the number of casualties was higher than could be expected had there been proper training and preparation.

Background

In June of 1994, sarin was released from a van traveling through a residential neighborhood in Matsumoto, Japan causing 600 casualties and 7 fatalities.ⁱ Although the incident received little media attention outside of Japan, it received massive coverage within Japan. The residential area was home to judges who were scheduled to make a ruling in a land dispute case with the Aum Shrin Kyo cult, which has been blamed for this incident.ⁱⁱ Despite suspects being named, no one was charged with the crime. In case after case involving the Aum Shrin Kyo cult, accusers have chosen to be silent or have been silenced.

After a Tokyo TV station taped a blistering interview with Tsutsumi Sakamoto, the station was visited by an Aum delegation...Four days later, on November 4, 1989, Sakamoto, his wife, and their year-old son disappeared. Friends found their apartment in disarray, and an Aum lapel badge on the floor."ⁱⁱⁱ

A shroud of fear surrounded the cult and it appears almost as if even the government was reluctant to challenge them.

On March 20, 1995, five makeshift chemical devices were placed on "three subway lines scheduled to converge from the north and west on [Kasumigaseki](#) [the government district] between 8:09 and 8:13 am...But only two bombs released sarin at the government station; three others were discovered either before or after their trains had reached the target area."^{iv} The poisonous vapors were intended for the government employees who worked in the Kasumigaseki area and the release was scheduled to affect the peak point of rush hour, just before the start of the 8:30 am workday.

Sarin Facts

Source: The MCW Digest Sarin Facts

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Only very small amounts of Sarin are needed to kill. A single milligram of Sarin coming in contact with the skin is sufficient to kill. In a vaporous form, it takes a concentration of 100 milligrams per cubic meter to be fatal. Nerve gases such as Sarin are known as "organophosphorus anticholinesterases" or "OP's." Their chemical method of killing is to

block the enzyme cholinesterase. The body's muscles receive electrical impulses caused by choline. Cholinesterases break down choline, making sure these impulses stop at the proper time. Cholinesterase attaches itself to choline and breaks it down, thus halting the impulse. Sarin fools the cholinesterase into acting upon the Sarin as it would choline. When the cholinesterase attaches itself Sarin, it doesn't break down. Thus, choline is not broken down, and the body goes into convulsions.

They first symptoms start in the eyes, where the pupils contract and vision is blurred. It causes breathing problems and chest tightness. Finally it produces vomiting and headaches, after which the heart and lungs stop as the body convulses. The antidote is a substitute for the missing cholinesterase, which is atropine. The armed forces in the Gulf War were given Oxime tablets in case of gas attack , which acts to release cholinesterase from the Sarin...

Sarin along with Tabun and Soman was invented not long before the Second World War by German scientist Dr. Gerhard Schrader. While developing insecticides similar to malathion and parathion, he discovered the first "nerve gas" agents, as they were then called. In 1936 he discovered Sarin. There Germans stockpiled these weapons during the Second World War, but never used them...

Sarin is now known as "GB." It has several chemical names: **1-Methylethyl methylphosphonate, Isopropylhydrogen methylphosphonate, or Isopropyl methylphosphonate**. Altogether there are four ingredients in Sarin: **phosphorus trichloride, sodium fluoride, isopropyl alcohol and acetonitrile**. Its chemical structure is as follows: **(H3C)2CGOPF(O)Me**. Sarin is not the type of weapon that can be made in the home, it can only be manufactured in a laboratory, though very sophisticated equipment is not needed. It is extremely dangerous to manufacture and handle.^v

Case

"The gas was leaked on three train lines -the [Marunouchi, Chiyoda and Hibiya](#)-all of which converge on Kasumigaseki station."^{vi} Subway passengers reported seeing people leaving packages or noticed unaccompanied packages spilling oily substances on the floor. Some passengers moved away from the packages and continued on to their stops, while others took part in mass evacuations from subway cars at the next station. One woman even remained on the subway, despite the onset of mild symptoms such as a headache and miosis, until it was announced that the subway was closed.^{vi} Symptoms of those mildly to moderately affected varied from headaches and miosis to vomiting and convulsions.

Firemen were the first emergency crews to arrive on the scene. The firemen were not only unauthorized to give antidotes, they were also completely unaware of what substance they were dealing with.^{vii} While some attempts were made a triaging the patients on the scene, those less severely affected hailed passing cars and taxis for transportation to hospitals. Upon arrival at the hospitals:

...the extent of decontamination of the casualties varied from hospital to hospital, and even within a single hospital...Miosis was the most common sign of poisoning. Other signs/symptoms were headache, dyspnea, nausea, vomiting, muscular weakness, cough, rhinorrhea, 'chest oppression,' and fascilations. Many casualties had 'psychological' effects, mostly anxiety. Three reported cases had pulmonary edema and metabolic

acidosis, both of which have been reported after insecticide but not nerve agent poisoning.

About 75% of the people who sought medical assistance had no effect from the agent. This is not unexpected. The people were afraid of an unknown and wanted to be reassured that they were not poisoned...This requires time and resources to triage these people.

The casualties were treated with atropine and pralidoxime. The dose of atropine was generally 0.5 mg and this was often administered at 15 minute intervals. Initially, some hospital staffs used reversal of miosis as an index of atropine effects, but later changed to other measures. Pralidoxime was given in varied doses, from 1 gm every 8 hours (for a total of 3 grams) to 0.5 gram every 30 minutes (for a total of 30 grams).

Plasma cholinesterase activity was estimated in most of the casualties; the ability to estimate the red cell enzyme activity was not available. The enzyme was inhibited corresponding to the severity of illness. In one hospital, the mean for the patient population was about 20% below the mean of the normal population. The enzyme was restored by pralidoxime, except in those instances where the oxime was given after "aging" (or after 3-4 hours).

In one hospital the staff initially felt that they were dealing with cyanide poisoning and gave several casualties sodium nitrite and sodium thiosulfate. In another hospital seizures were treated with barbiturates. Most hospitals used diazepam for seizures. Ventilation and airway support were supplied as needed.^{vii}

There was hardly any consistency among the treatment of victims in the various hospitals in Tokyo, yet casualties remained low.

As of noon March 21, 5510 people had reported to medical facilities...948 in the mild category (miosis and other eye signs only), 37 in the moderate category (miosis plus other signs/symptoms such as dyspnea or nausea), and 17 in the severe category (requiring ventilatory assistance). Eight people died on the first day... four others died in the following month. Over 4000 had no signs or symptoms.^{vii}

While casualties were low, the amount of fear the attack generated increased triage time due to the enormous amount of those reporting for medical treatment.

Conclusion

Casualties in this terrorist incident remained low, not because of the preparedness of the Tokyo medical and rescue personnel, but due to the inefficient method of dissemination. Had the vapors been blown through the subway cars or been more than 50% pure, there may have been more casualties.^{vii} Although the Matsumoto incident set the stage for the Tokyo subway gassing incident, as far as medical personnel's response is concerned, it appears as though the Japanese were caught off guard. Plans were already in the works for raids on the Aum Shrin Kyo cult communes, which allowed the Tokyo police and medical forces to be prepared for chemical exposure, as there were already indications that the cult was involved in illegalities.ⁱⁱ

The US medical team that was sent to assist the Tokyo medical personnel after the crisis recommended the following disaster preparedness steps be taken in the event of another chemical weapons discharge:

1. Establishing effective public warning systems,
2. Coordinating emergency public health information,
3. Developing strategies to protect public health,
4. Planning for large-scale patient decontamination,
5. Ensuring an adequate supply of antidotes, and
6. Providing proper PPE for health professionals.^{vii}

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Indepth Resources

Nerve agent information:

Army Field Manual 8-9: Handbook On The Medical Aspects Of NBC Defensive Operations. Part III, Chapter 2.

Aum Shrin Kyo Cult:

Sayle, Murray. "Letter From Tokyo: Nerve Gas and the Four Noble Truths. *The New Yorker*. 04/01/96.

ⁱ Morita, Hiroshi, Nobuo Yanagisawa, Tami Nakajima, Mikio Shimizu, Hidemitsu Hirabayashi, Hiroshi Okudera, Masahiko Nohara, Youko Midorikawa, Shohei Mimura. Sarin poisoning in Matsumoto, Japan. *The Lancet* 1995; **346:290-293**.

ⁱⁱ Van Biema, David. Prophet of Poison: After Tokyo suffers a nerve-gas attack, suspicion focuses on the leader of an apocalyptic cult. *Time* 1995;**145:14**; <http://pathfinder.com/>.

ⁱⁱⁱ Sayle, Murray. "Letter From Tokyo: Nerve Gas and the Four Noble Truths. *The New Yorker*. 04/01/96.

^{iv} Strasser, Steven, Hideko Takayama, Kay Itoi, John Barry, Andrew Nagorski, Robin Sparknan, Maggie Boitano. A Cloud of Terror And Suspicion. *Newsweek* April 3, 1995;36-41. ^v *The MCW Digest*. Sarin Facts.

^{vi} Bilski, Andrew, Suvendrini Kakuchi. Tokyo Terror: A sect comes under suspicion after a gas attack kills 10. *Macleans* April 3, 1995; **28-30**.

^{vii} Sidell, Frederick R., MD. Untitled transcript of speech.