

**THE CITY OF NEW YORK
OFFICE OF CHIEF MEDICAL EXAMINER**



Death in a carbon dioxide therapy bath

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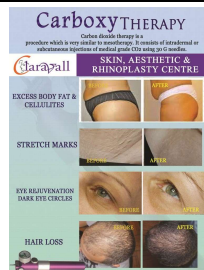
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Learning objectives

1. Recall the maximum concentration of carbon dioxide that is immediately dangerous to life in humans.
2. Define the route of administration of carbon dioxide gas in carbon dioxide therapy baths.
3. Describe the mechanism of death in cases of oxygen deprivation and displacement.

Introduction

- Carbon dioxide (CO2) therapy is the subcutaneous or transcutaneous administration of CO2 for therapeutic purposes
- Two common uses:
 1. Localized lipolysis
 2. Chronic wounds or other skin conditions
- Considered as a safe alternative/complementary medical treatment



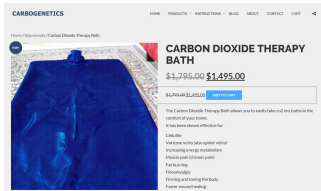
Carbon dioxide therapy

- In Europe, spa centers offer full body CO₂ therapy baths
- The client is placed into a full body bag with space for his/her head to stick out
- The bag is then infused with CO₂ gas with an optimal concentration between 1000-1400 mg/L



Carbon dioxide therapy

- Commercially manufactured, air-tight bags and accompanying apparatus designed to provide CO₂ baths can be purchased for at home use



Screenshot taken from: <https://www.carbogenetics.com/product/ejuvemat/>

Carbon dioxide

- Carbon dioxide occurs naturally in the atmosphere and makes up approximately 0.03% of the atmosphere.
- At standard temperature and pressure, the density of carbon dioxide is about 1.67 times that of air
- Carbon dioxide is heavier than air, colorless and odorless at low concentration, but at high concentration has a sharp, acidic odor

Carbon dioxide levels

- The Center for Disease Control (CDC) has designated 100,000 ppm (or 196 mg/L) of carbon dioxide as immediately dangerous
- Signs of intoxication have been produced by a 30-minute exposure at 50,000 ppm

Use of carbon dioxide gas

- The deadly aspect of CO₂ is applied to euthanasia of wild and laboratory animals
- Advantages:
 1. No injection, handling, or transfer required
 2. Painless
 3. Relatively safe to the technician

Carbon dioxide deaths

- Few human CO₂-related deaths have been reported, mostly accidental in manner
- Entrapment in a closed environment in the presence of "dry ice", or solid carbon dioxide.
- To date, there have been no reported deaths of a human undergoing a CO₂ therapy at home.

Index Case

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- Middle aged male health enthusiast
- Self employed fitness and wellness counselor
- No history of substance, alcohol abuse
- No history of psychiatric illness

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- Lived alone in apartment owned by his sister who communicated with him regularly
- Last seen alive two days prior to decedent's discovery by a neighbor
- Active on social media, with decedent's sister reported a recent Facebook comment about receiving a new tank for presumed wellness reasons

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- The body was discovered in a large blue bag, attached to the tank apparatus, on the floor
- No signs of forced entry, or suicidal notes found
- No prescription medications or illicit substances seen
- Various over the counter vitamins, supplements, medical testing strips and cannabinoid derivatives were found

Examination

- Body found in an air-sealed, tightly wrapped CO₂ therapy bag
- Autopsy unremarkable
- Toxicology unremarkable

Equipment

- The bag was connected to a working pump attached to a CO₂ gas tank
- The pump was connected to the bag by two tubes comprising an inflow and outflow circuit
- The inflow tube for CO₂ gas delivery was partially disrupted, while the outflow tubing remained intact

Equipment

- This CO₂ therapy bath was purchased on-line through a company that sells at home CO₂ therapy devices.
- The empty gas tank was purchased online, and filled through a local welding supply center.

Mechanism

- The occupant inadvertently slipped inside the bag and was completely enveloped
- The rupture of the inflow tube permitted the CO₂ gas to fill up the room, instead of the bag.
- High concentration of CO₂ likely ensued

Mechanism

- The intact outflow tube was attached to the vacuum component of the pump (still on)
- The decedent's head was inside the bag instead of positioned through the neck seal
- The bag collapsed, and vacuum sealed around the decedent
- The gas tank was found empty, proving that CO₂ was leaking into the room with closed windows

Death

- Cause of death: Asphyxia by vitiated atmosphere
- Displacement of oxygen by CO₂ and low pressure created inside a CO₂ therapy bath
- Manner of death: Accident

Manufacturer update

The screenshot shows the 'CO₂ SAFETY' section of the CarboGenetics website. It includes a warning about CO₂ concentration and a list of four safety instructions. Red arrows point to the following text:

- 1- You must have a partner/assistant helping you take the bath. They must have gone through our safety course and sign the app every time you take the CO₂ bath that they are there with you.
- 2- You must have the CO₂ Meter Alarm in near the head of the individual. This will alert you of any leaks in the tank or regulator.
- 3- The CO₂ bath must be taken at least 3 feet above the ground such as a massage table, bed or couch. CO₂ is heavier than air so accumulates on the floor.
- 4- Always take the CO₂ bath in a well ventilated area.

Manufacturer update

The screenshot shows the bottom portion of the 'CO₂ SAFETY' section. Red arrows point to the following text:

- 3- Before getting out of the bath make sure all CO₂ is vacuumed out using the hose through a window.
- 6- CO₂ baths should not last longer than 1 hour.
- 7- Make sure to always consult a physician before using the CO₂ bath.

Below the list, there is a warning: "When using a CO₂ rebreather for your fish tank or making beds or beer you should always use caution and know the CO₂ levels in the area where the tank is. Make sure your CO₂ Meter Alarm has batteries in it that are charged."

Acknowledgments

- Thank you to the NYC OCME, especially to the photographers and medicolegal investigators who worked on this case
- Thank you to Dr. Georgievskaya for her tremendous input in the preparation of this case presentation

References

1. Brandi C, D'Aniello C, Grimaldi L, Bosi B, Dei I, Lattarulo P, et al. Carbon dioxide therapy in the treatment of localized adiposities: Clinical study and histopathological correlations. *Aesthetic Plast Surg.* 2001;25(3):170–4.
2. NIOSH. Immediately dangerous to life and health concentrations (IDLH): Carbon Dioxide. Last updated on December 4, 2004. Accessed on May 13, 2018 from: <https://www.cdc.gov/niosh/idlh/124389.html>

Questions?
