Oxygen First Aid for Scuba Diving Injuries

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Oxygen Provider Registration

- DAN Oxygen Provider Registration Form
- Statement of Understanding
- DAN Membership Form
- Other Administrative Procedures
- Introductions
  - DAN Oxygen Instructor & Staff
  - DAN Oxygen Provider Candidates

Oxygen Provider Course Overview

- What is DAN?
- Anatomy & Physiology
- Diving Injuries
- Oxygen
- Benefits of Oxygen

DCS

CO_2

AGE

O_2

DCI

Oxygen Provider Course Overview

- Oxygen Equipment
- Providing Oxygen First Aid
- Recommendations for Oxygen Providers
- Oxygen Provider Skills Development
- Exam and Review

What is Divers Alert Network?

The Mission of DAN

- Divers Alert Network (DAN), a nonprofit organization, exists to provide expert information and advice consistent with current medical literature

- Provides emergency medical advice and assistance for underwater scuba diving accidents, works to prevent accidents and promotes diving safety

The Mission of DAN

- Promotes and supports underwater diving research and education, particularly as it relates to the improvement of diving safety, first aid and medical treatment

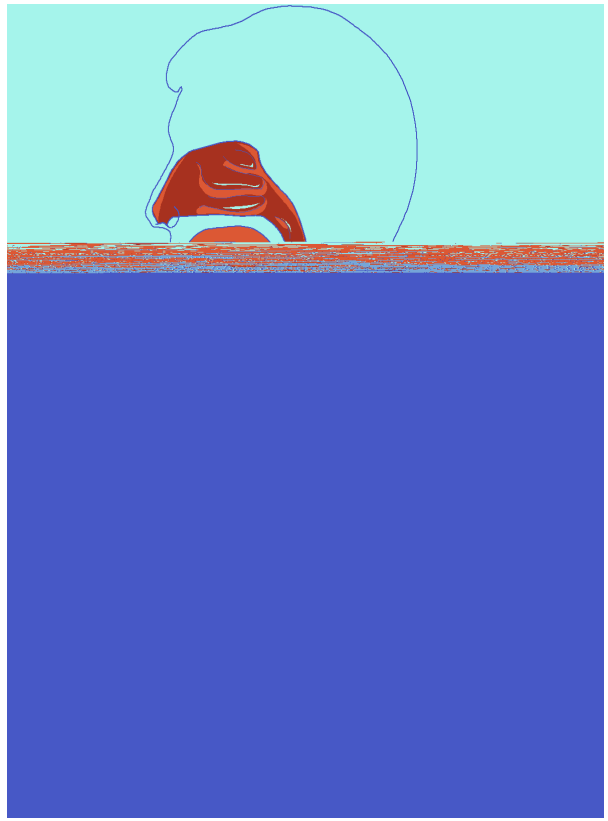
- Provides accurate, up-to-date, and unbiased information on issues of common concern to the diving public, and advocates for divers' concerns for diving safety

DAN Services

- DAN Medicine
  - Diving Emergency Hotline
  - Diving Medicine Information
  - Chamber Assistance
- DAN Training
- DAN Membership
  - DAN TravelAssist
  - Alert Diver
  - Dive accident insurance eligibility
- DAN Research

Respiratory System

- Consists of mouth, nose, airways, muscles between the ribs, diaphragm and lungs
- Function is to exchange gases between the body and the environment

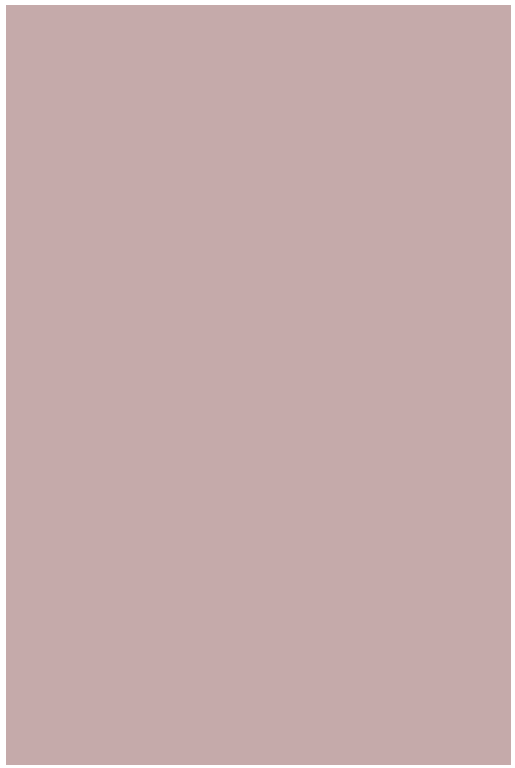


Respiratory System

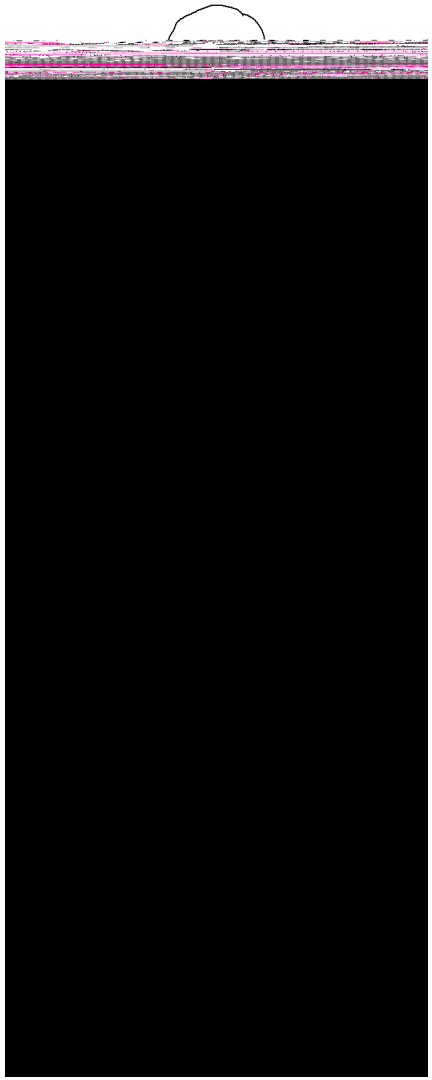
- Body requires a constant supply of oxygen to function
- Interruption of the supply of oxygen leads to hypoxia, or an inadequate supply of oxygen to the body tissues
- Brain and other areas of the central nervous system are the most affected by the lack of oxygen

Respiratory System

- Gas exchange is the uptake of oxygen from the air spaces in the lungs and the removal of carbon dioxide from the blood
- Gas exchange occurs through the alveoli in the lungs



Circulatory System



- Consists of the heart, blood and blood vessels
- Function is to transport blood which carries oxygen, carbon dioxide and other nutrients to cells of the body

Respiratory and Circulatory Systems

- Air contains approximately 21% oxygen and 79% nitrogen
- During respiration, the body uses only some

Diving Injuries

The Nature of Diving Injuries

- Recognition of a diving injury is based on
  - Recent history of scuba diving
  - Presence of signs and symptoms
- There is no definitive test or unique signs to confirm the existence of DCI for the rescuer
- Broad range of signs and symptoms
- Similar to many other illnesses and injuries

Near-Drowning / Submersion Incident

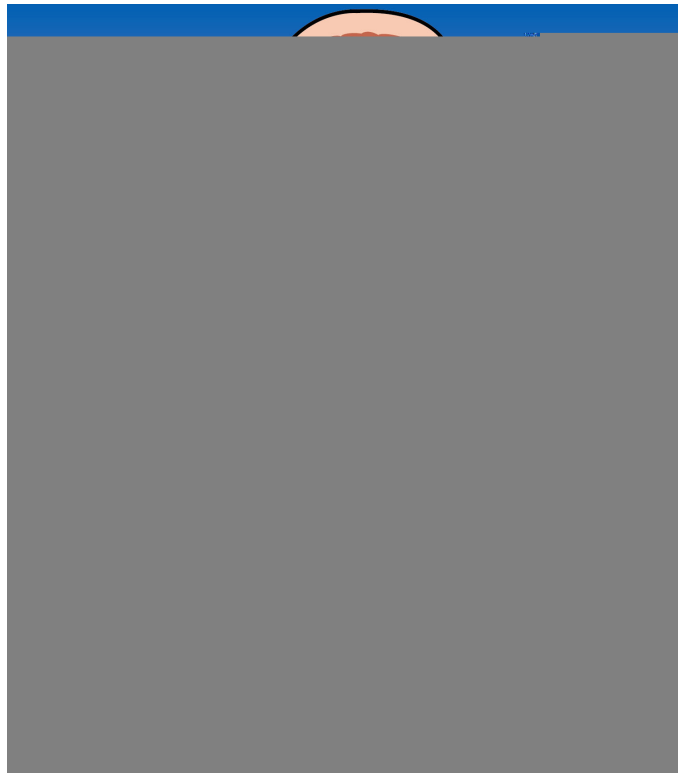
- Results from suffocation due to submersion in water
- Impairs the ability of the lungs to perform gas exchange
- May include aspiration of fluids into the lungs
- Results in hypoxia and possibly respiratory and cardiac arrest
- Contributing factors include diver panic and over-weighting

Decompression Illness

- Decompression illness (DCI) is used to describe the signs and symptoms of an injury caused by breathing gas at depth
- DCI encompasses both arterial gas embolism (AGE) and decompression sickness (DCS)
- First aid treatment for both AGE and DCS is the same

Arterial Gas Embolism

- Overexpansion injury of lung
- Gas enters bloodstream
- Travels to heart and arterial system
- May block major arteries
- Cuts off supply of oxygenated blood
- Commonly affects brain

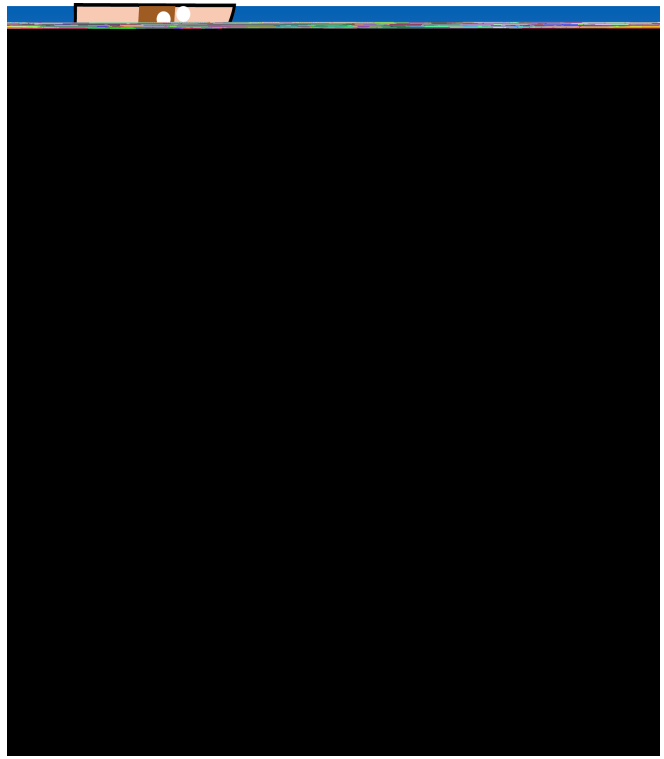


Arterial Gas Embolism

- Often has rapid and dramatic symptom onset
- Contributing factors include rapid ascent, breathholding, lung damage, lung congestion, asthma or other air-trapping mechanism
- May accompany other pulmonary barotrauma
- AGE is the most serious result of a lung expansion injury

Decompression Sickness

- Nitrogen is absorbed by the tissues during the dive
- Result of bubble formation and growth during and after ascent
- Effects can include distortion or tearing of tissue, reduction or stoppage of blood flow, and activation of blood clotting mechanisms

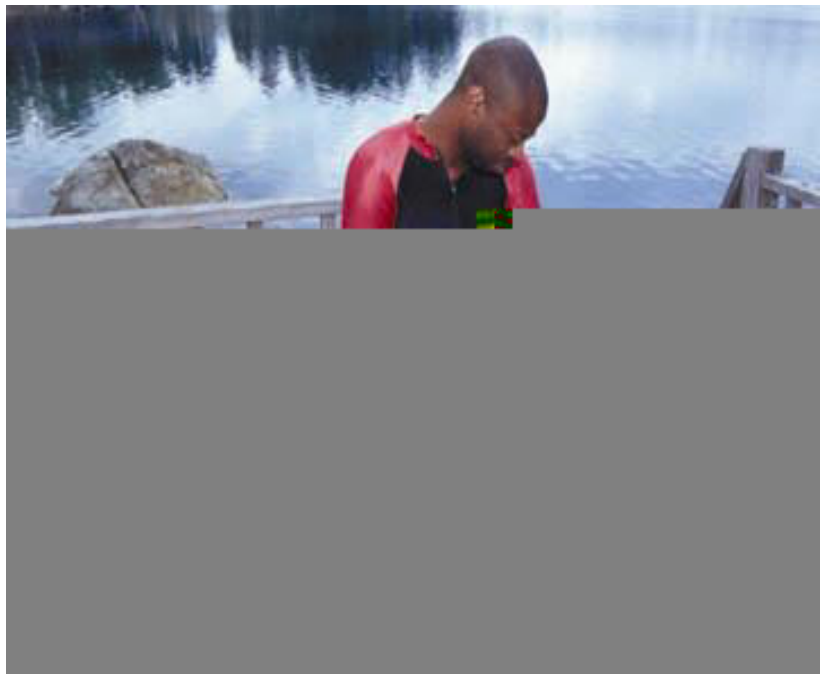


Decompression Sickness

- Usually has delayed symptom onset
- Contributing factors for bubble formation include excess nitrogen, rapid ascent, decreasing pressure such as flying after diving
- Bubbles as a result of DCS cause various signs and symptoms based on their location
- Any area of the body may be involved
- Since first aid for DCI is the same, avoid trying to differentiate between them and provide oxygen

Common Warning Signs

- Numbness
- Pain
- Headache
- Weakness
- Dizziness
- Unusual fatigue
- Nausea
- Difficulty walking



Other Warning Signs

- Altered skin sensation
- Rash and itching
- Difficulty breathing
- Visual disturbance
-

Important Notes About Warning Signs

- DCI usually involves multiple warning signs
- Onset time for DCI varies from during the dive up to 24 hours or more post-dive

Oxygen

What is Oxygen?

- Oxygen is the essential component of air that sustains life
- Oxygen is a colorless, odorless and tasteless gas
- Oxygen is also used for medical purposes to prevent or treat hypoxia in an emergency and for long-term medical care

Oxygen Cylinder Filling

- Oxygen grades
  - Use only medical or higher grade oxygen suitable for breathing
- Oxygen cylinder filling requirements
  - Prescription
  - Documentation of training
  - Other
- Oxygen laws and regulations

Hazards of Breathing Oxygen

Breathing high concentrations of oxygen for extended periods can cause oxygen poisoning or toxicity

- Two forms of oxygen toxicity
  - Central nervous system (CNS) oxygen toxicity
  - Pulmonary oxygen toxicity
- Oxygen toxicity is not a concern for the DAN Oxygen Provider rendering first aid

Oxygen Safety

- Extinguish all flames and smoking material
- Do not use in the presence of oils, grease or flammable substances
- Always use in well-ventilated areas
- Use only equipment designed for use with oxygen
- Maintain and service equipment as required
- Always secure oxygen cylinders during transport

The Benefits of Oxygen

Oxygen first aid may:

- Reduce bubble size
- Oxygenate hypoxic tissues
- Reduce tissue edema
- Ease breathing
- Relieve symptoms
- May reduce the risk of residual symptoms after hyperbaric treatment

Oxygen Equipment

Oxygen Equipment

General Rules

- Demand system is preferable over a constant-flow system because
  1) 100% oxygen may be provided
  2) Oxygen is not wasted
- Cylinder capacity should allow for oxygen to be provided from the dive site to the nearest medical facility
- Be trained for the oxygen delivery device you plan to use
- Check oxygen equipment and cylinder pressure before every dive outing

Oxygen Cylinders

- Types
- Material
- Valves
- Color-coding
- Labeling
- Maintenance
  - Hydrostatic testing
  - Storage

Non-rebreather Mask

- Can be used with breathing divers only
- Recommended initial flow rate is 15 lpm
- Reservoir bag must be primed and kept inflated while providing oxygen to an injured diver
- Its use is recommended when there is:
  - Second injured diver
  - Demand valve is not tolerated

Oronasal Resuscitation Mask

- May be used with both breathing and non-breathing injured divers
- Recommended flow rate is 15 lpm
- Provides increased oxygen concentration up to 50 percent versus only 16 percent with only your expired breath
- It is also an effective barrier device

MTV-100: Flow-restricted oxygen-powered ventilator

- Can provide 100 percent oxygen for both breathing and non-breathing injured divers
- It uses a demand valve for breathing injured divers
- Manually triggered ventilator allows for use with non-breathing injured divers
- Additional training is

DAN Oxygen Units

- Provide 100 percent oxygen
- Can be used for both breathing and non-breathing injured divers
- Can provide oxygen to multiple injured divers at the same time
- Are housed in a waterproof case
- Various cylinder sizes and numbers are available based on time to definitive medical treatment

Skills Development Session Overview

Scene Safety Assessment

Remember S-A-F-E

- S - Stop
- A - Assess scene
- F - Find and secure first aid kit, oxygen and AED units
- E - Exposure protection

Initial Assessment with Basic Life Support

- Remember SAFE
- Assess responsiveness
  - Activate EMS
- Open airway
- Assess breathing
  - Look, listen and feel for up to 10 seconds
  - Provide 2 rescue breaths, if not breathing
- Assess signs of circulation for up to 10 seconds
  - If there are signs of circulation but no breathing, continue rescue breathing
  - If there are no signs of circulation, begin CPR

Providing Care with an AED (Optional)

- Assess ABCs
- Verify no circulation
- Attach the defibrillator pads
- Allow the AED to analyze heart rhythm
  - Don't touch the patient
- If shock required:
  - Follow the AED unit's prompts
  - Visually and physically clear the patient
  - Say “Clear”
  - Administer shocks
- If no shock required, begin CPR

Demand Inhalator Valve

- Remember SAFE
-

Non-rebreather Mask

- Remember SAFE
- Assure the ABCs
- Connect mask to regulator
  - Set regulator flow rate to 15 lpm
  - Prime reservoir bag
- Place non-rebreather mask on the diver's face
- Check for leaks around the mask edges
- Monitor injured diver

Proper Positioning

- If the person is breathing and responsive:
  - Place in either the supine or recovery position
- If the person is breathing and unresponsive:
  - Place them in the recovery position
- If the person is not breathing:
  - Place them in the supine position

Disassemble, Clean and Assemble the Unit

- Follow these steps to disassemble, clean and assemble pRc T2l531.6608 11gs0

Emergency Assistance Plan

- Diver Information
  - Name
  - Age or Date of birth
  - Address
  - Emergency contact phone
  - Current complaint(s)
  - Past medical history including current medication
  - Dive profile(s)
  - Drug allergies
- General Information
  - Emergency contact information (EMS, DAN)
  - Initial contact phone number (Call back #)
  - Directions to nearest medical facility
  - DAN phone numbers
  - Other

Recommendations for Oxygen Providers

Oxygen Provider Flowchart

Recommendations for Oxygen Providers

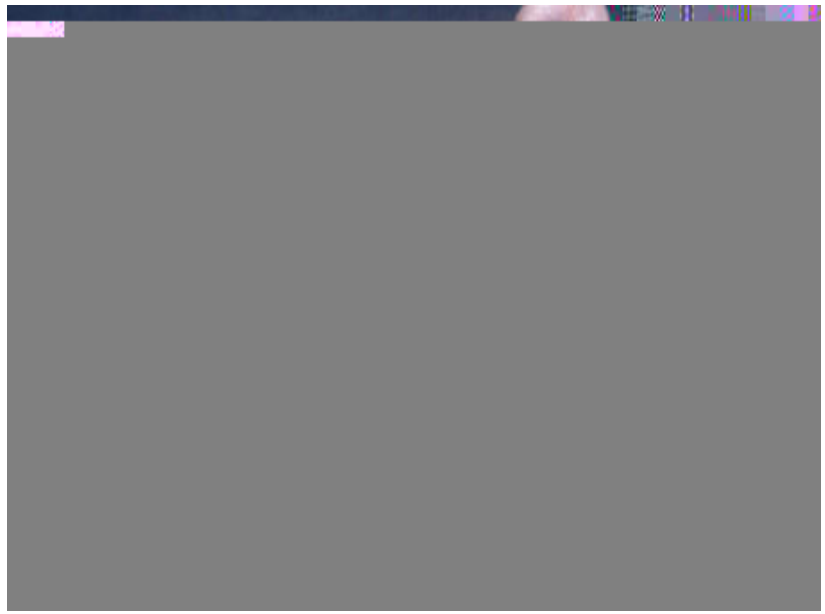
- Remember scene safety assessment – SAFE
- Ensure the Airway, Breathing & Circulation – ABCs
- Provide the highest concentration of oxygen possible
- Have enough oxygen to supply high concentrations of oxygen until emergency medical services arrive
- Practice oxygen first aid skills frequently
- Place injured diver in the most appropriate position

Oxygen and the Law

- Good Samaritan Laws
- Providing oxygen to an inured diver improves the diver's chance of complete recovery
- Providing oxygen can cause no further harm to an injured scuba diver
- Local oxygen laws and regulations
  - Equipment requirements
  - Oxygen cylinder filling requirements
  - Other

Oxygen Provider Skills Development Session

- Scene safety assessment
- Basic life support review
- Injured diver scenarios using:
  - Demand inhalator valve
  - Non-rebreather mask
  - Oronasal resuscitation mask with supplemental oxygen
- Equipment disassembly and assembly



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