LAUGHING GAS- AN ANALGESIC IN DENTISTRY

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Introduction

On 10th december1844, Horace Wells, a dentist of Hartford, Connecticut attended a 'lecture exhibition' by an itinerant scientist Gardner Quincy Colton[1] and recognized the anaesthetic property of (N_2O) Nitrous oxide[2] .The following day, Wells requested Colton to extract one of his teeth by administering N_2O on him by an inhaler in front of another dentist William Riggs, a witness[3]. But Wells' success and overconfidence led him to failure. In January 1845 while he was demonstrating an amputation publicly in Harvard Medical School Boston, under N_2O analgesia, the patient cried out in pain because his technique probably was not correct . The pioneer Dentist Wells, who was the first one to recognize the anaesthetic qualities of N_2O, became insane out of frustration. He was arrested for throwing acid at two women in Newyork city and committed suicide in 1848 [4]

Key words : Nitrous oxide,analgesic, entonox, agranuolocytosis

Preparation

N_2O was first prepared by Joseph Priestly in 1773 by heating Ammonium nitrate with iron. The gas evolved was passed through water to eliminate toxic oxides of nitrogen[5]. In 1790s, Humphrey Davy, a British Chemist noted its exhilarating effect and nitrous oxide gained its nick name-'laughing gas'. In 1800 he published "As nitrous oxide… appears capable of destroying pain, it may probably be used with advantage during surgical operations." In 1868 Edmund Andrews, a Chicago surgeon, made it popular in dental surgery using it with oxygen.[6].

Physical property

Non-flammable,though helps in combustion even in the absence of O_2 (Neuman et al,1993).It is of low molecular weight, sweet smelling and of poor blood solubility (0.46). Inhalation of the gas increases the incidence of nausea and vomiting (Divatia et al., 1996 Fisher, 1996; Hartung,1996)

Diffusion hypoxia-occurs when inhaled N_2O is withdrawn abruptly. High volume of N_2O from the blood stream comes to alveoli(Fink,1955) and dilutes the (lung) pulmonary O_2 (PaO_2) and also CO_2 ($PaCO_2$)which is a stimulus for respiration(Sheffer et al., 1972). The outpouring of N_2O thus causes fall of O_2 satuation of blood.This results in hypoxia which is called as diffusion hypoxia. So after discontinuing N_2O, inhalation the lung must be filled up with O_2 alone atleast for five minutes[7]

Availability in royal blue coloured cylinder as pure N_2O or in body blue and shoulder white coloured cylinder as a mixture of N_2O & O_2 in 50:50 composition(entonox).A full cylinder of N_2O at room temparature contains liquid N2O not vapour. So the cylinder should be kept upright when in use.The pressure gauge thus is not an indicator about the quantity of the gas remaining in the cylinder. Entonox but remains in gaseous form unless temperature drops below -70C.In such a condition a thorough mixing of the gas is necessary before using the cylinder[8].

Latent heat of vaporization required for the conversion of liquid gas to gaseous form, is proportional to the amount of substances vaporized. So when from a cylinder of liquified gas ,the flow of N_2O is more, latent heat of vaporization increases and the temperature of the cylinder decreases. As a result the saturated vapour pressure in the cylinder falls in an increasing rate and no gas can be obtained from the cylinder . The flow of gas can be obtained again by turning off the cylinder for a minute. The pressure inside the cylinder then builds up, the magnitude of latent heat of vaporization falls and conversion of liquid occurs. It was a regular feature in dental anaesthesia when high flow of N_2O from small portable cylinder were used.

Clinical use

Good analgesic. The analgesic effect is observed after 2-3 minutes of inhation of 50% N2O . The effect is titrable. It can be used as a sole analgesic agent for procedures involving gums[9] But when used for anaesthetic purpose a second agent needs to be added .

Entonox is used for alleviating pain in minor procedures in dentistry.

Adverse effect

6 litre/mint for six hours continuous inhalation gives pain relief equivalent to 50mg of Pethidine/30mg of Pentazocine (Fortwine) but results in megaloblastic anaemia and agranulocytosis. Chronic exposure to high concentration may cause a condition resembling subacute

combined degeneration of the spinal cord[10]

Precaution

(a) Respiratory tract disease when the gas is used as a sole analgesic agent. Because it diffuses into closed air space causing significant expansion of lung bullae

(b) First trimester of pregnancy ,the gas may be teratogenic,(c) bloked nose,(d) full stomach may induce vomiting.

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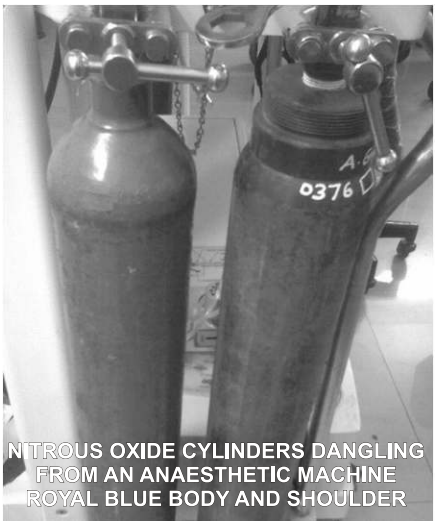
ENTONOX CYLINDER BODY BLUE SHOULDER WHITE



NITROUS OXIDE CYLINDERS DANGLING FROM AN ANAESTHETIC MACHINE ROYAL BLUE BODY AND SHOULDER