SOLVE THE CUBE AND BREATHE: CASE REPORT OF NITROGEN METHOD IN ASSISTED SUICIDE

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ABSTRACT

COVID-19 pandemic has psychological and social effects that arise in the present and may arise in the future. There have been already many cases of COVID-19 related suicides in the US, UK, Italy, Germany, Bangladesh, India and other countries.

Fatal poisoning by toxic gases occurs mostly in accidental or occupational fatalities but also in suicidal events. In the forensic practice, nitrogen inhalation fatalities are very rare. In the presented case a 47-yr-old man committed suicide with a handmade device: a breathing tent made from a plastic water bag clung to his neck and that covered his face, connected by the tube to a valve on a large cylinder of industrial nitrogen gas. There was also a solved Rubik's cube besides the body. His parents told the police that he had been depressed and in the last time he complained about worsening of symptoms due to COVID 19 pandemic.
In scientific literature there are only two similar cases to the one described in this article.

In conclusion, since suffocating gases do not leave specific autopsy findings and nitrogen is a normal constituent of the blood gases, postmortem toxicological studies could be inefficacious to determine the cause and manner of death. In a case involving nitrogen gas inhalation there is the need of thorough investigations of the scene as well as of the circumstances surrounding the death evaluating also a creative way to commit suicide.

Keywords: Suicide, Nitrogen inhalation, Covid 19, Trazodone

INTRODUCTION

Worldwide, almost 800 000 people die by suicide every year (WHO 2018) (Zalar, 2018; Grattagliano et al., 2019).

COVID-19 pandemic has psychological and social effects that arise in the present and may arise in the future. There have already been many cases of COVID-19 related suicides in the US, UK, Italy, Germany, Bangladesh, India and other countries (Cascella et al., 2020; Ornell et al., 2020; Sher, 2020; Miller, 2020; Dunmore, 2020).

Social isolation, anxiety, fear of contagion, uncertainty, chronic stress and economic difficulties can lead "fragile" subjects to suicide; individuals with pre-existing psychiatric disorders are often included, besides people who have a family member or friend who died from COVID-19 (Lieberman et al., 2020; Sher, 2019).

Psychiatric patients previously in pharmacological compensation, due to difficulty in accessing treatment, often can arrive at suicide (Kohn et al., 2004; Kessler et al., 2007).

Worldwide and in Europe, the predominant choice of suicidal method for men and women is hanging (Ajdacic-Gross et al., 2008; Värnik et al., 2007). Among European men, hanging was followed by death by firearms and poisoning by drugs, respectively.

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It may not be surprising that hanging is the most common suicide method in most countries, since it is largely available (Lester, 1990).

However, preferred suicide method varies according to individual factors, cultural context and occupational categories (Carfora et al., 2021; Feola et al., 2017).

In this case study, the cultural knowledge of the subject who committed suicide made it possible to choose a suicidal means largely present in nature which, however, allowed a less traumatic death. The Authors report the suicide of a 47 year-old man committed by inhalation of nitrogen gas.

In scientific literature there are only two similar cases to the one described in this article. (Straka et al., 2013; Harding, 2008).

Normal oxygen concentration in the air we breathe is approximately 21%. If oxygen concentration in the air decreases, or if the concentration of any other gas increases, we quickly arrive at a situation that presents a significant risk of asphyxiation, with cognitive abilities that are reduced while the affected person does not feel such effects.

Nitrogen is the principal component of earth's atmosphere [14] and it is included in the group of pnictogen and pnictide; these words are derived from the Greek root pnikta, "suffocated things", in allusion to the German name for nitrogen, Stickstoff, or "suffocating substance".

Thus, in simple terms it means "suffocator maker", therefore nitrogen, like other gases, is a simple asphyxiating gas (Gregory, 2009). It can displace oxygen from inhaled air causing a life-threatening condition which leads to rapid loss of consciousness and death within minutes (Stemberga et al., 2007)

CASE STUDY

A 47-yr-old male professor of law was found lying in the bedroom of his rented house in a little town of south Italy, approximately at 8:00 p.m. on a day of March.

His parents found him lying on his bed in a supine decubitus position without pants and underpants, covered only with sheet and blanket.

FIGURE 1
CORPSE POSITION AT THE TIME OF DISCOVERY. PLEASE NOTE: THE SUICIDE DEVICE WAS REMOVED FROM THE FATHER

The decedent was found with a handmade breathing device made from a water bag clung to his neck and which covered his face. This device has been connected through a hose to a cylinder of industrial N2 gas placed next to the bed.

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FIGURE 2
HANDMADE BREATHING DEVICE CONNECTED TO A CYLINDER OF INDUSTRIAL N2 GAS

When we arrived the cylinder valve was closed, perhaps closed by the parents. A resuscitation attempt by the emergency physician was not carried out due to the presence of rigor and post-mortem lividity. The plastic bag was torn by the decedent's father, who found the body. During the crime scene inspection, the authors found the shipping packaging and the purchase invoice of nitrogen under the bed. The scene was otherwise unremarkable with no signs of struggle and no suicide note.
There was also a solved Rubik's cube besides the body.

FIGURE 3
DETAIL OF THE PRESENCE OF A SOLVED RUBIK'S CUBE NEXT TO THE BED

The subsequent investigations of the deceased's computer showed the many searches carried out by the patient on the internet for the choice of suicide mode and that the nitrogen had been bought in an internet shop.

His parents told the police that he had been depressed and in the last time he complained about worsening of symptoms due to COVID 19 pandemic. The time of isolation in the house favored such research. The authors also found numerous packs of drugs on the table, most of them psychiatric. After external examination of the body, we get a blood sample to analyze the concentration of drugs in the blood.

Toxicological Analyses

Samples of blood were investigated using specific methods (Headspace gas chromatography; Ultrafiltration-liquid chromatography/mass spectrometry, UFLC-MS) (Patel et

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al., 2008). Toxicology tests showed negative results for ethyl alcohol, drugs, and other volatile compounds. The UFLC-MS results showed that the only drug present in the deceased's blood was trazodone.

Experimental Chemicals: Trazodone hydrochloride, methanol, acetonitrile, formic acid, ammonium formate, and zinc sulphate monohydrate were obtained from Merck (Darmstadt, Germany). Precipitation solution of zinc sulphate was obtained by solubilizing 17 g of zinc sulphate monohydrate in 1 L of water: methanol solution (20:80).

Material: The instrument system consisted of an Ultra-Fast Liquid Chromatography (UFLC) XR Shimadzu separation module connected to an Agilent Mass Spectrometry (MS) 4000 QTRAP operating in Enhanced Product Ion Scan (EPI) and acquiring in Multiple Reaction Monitoring. An Allure PFP Propyl 5 µm, 50x1.2 mm (Restek-VWR, Milan, Italy) column was used to perform the separation. The mobile phase consisted of water added with 2 mmol of ammonium formate and 0.2% formic acid, as phase A, while phase B was acetonitrile added with 2 mmol of ammonium format and 0.2% of formic acid. The flow rate was set at 0.5 ml/min, and the following gradient elution profile was applied: 0–1.1 min at 100%A, 1.11–6.1 min from 10%B to 90%B, 6.11-9.0 min 90%B, 9.1 to 9.5 min from 90%B to 10%B and 9.6-12.5 min 100%A. The auto sampler temperature was at 4◦C, and the injection volume was 10 mL. The total LC run time was 12.5 min. The optimal transitions chosen for quantitation and confirmation of trazodone are 372 to 176 m/z and 372 to 148 m/z, respectively. Acquisition time was 12.5 min.

Sample Preparation: In a 1 ml Eppendorf tube, 50 µL whole blood and 113 µL of zinc sulphate solution were added and swirled for 30 s, then the sample was left for 10 min at room temperature. Subsequently, the sample was centrifuged at 15.000×g for 10 min. The clear supernatant was collected into a recovery vial that was inserted in the instrument sample tray.

Results: The retention time was 3.45 min for trazodone (Figure 4). Its calibration curve in blood was linear over a range 4-400 µg/L (r=0.996, seven calibration points, repeated three times). The LOD and LOQ of the method were 2 µg/L and 6 µg/L, respectively.

These results accord with Patel et al. [14] findings that, using LC- MS, reported a lower limit of quantitation of 10 µg/L. In the reported case, the postmortem whole blood sample showed a concentration of 22 ng/mL trazodone. This value is far less low than both the trazodone therapeutic standard concentrations (2 mg/L) and the potentially lethal concentrations (up to 9 mg/L) reported in literature (Goeringer et al., 2000; Parker et al., 2004).

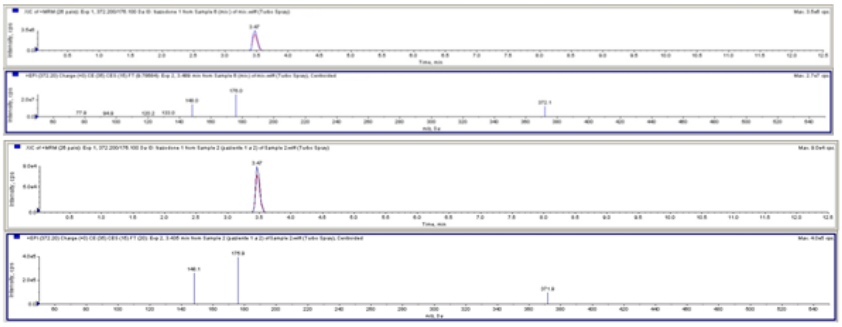

FIGURE 4
CHROMATOGRAMS AND MASS SPECTRA OF TRAZODONE STANDARD (A) AND POSTMORTEM PATIENT'S SAMPLE (B)

What is Trazodone: Trazodone is a serotonin receptor antagonist and reuptake inhibitor used extensively as an anxiolytic in human and small animal veterinary medicine, it is also FDA-approved for the treatment of depression and has been used by mental health and primary care providers for the treatment of multiple psychiatric and medical conditions (Khouzam et al., 2017; Davis et al., 2018).

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The cause of death was assumed to be suffocation caused by plastic wrap covering the face, combined with nitrogen inhalation.

DISCUSSION

Fatal poisoning by toxic gases occurs mostly in accidental or occupational fatalities but also in suicidal events (Carfora et al., 2019; Maebashi et al., 2011; Rupp et al., 2013).
In the forensic practice, nitrogen inhalation fatalities are very rare.
Exposure to low oxygen concentration respirable gas mixtures can occur in several situations:

- Accidental exposure to places where lack of oxygen is accompanied by an enrichment of inert gases in the air (Moskowitz, (n.d.); Auwarter et al., 2004).
- The high pressure of inert gas dissolved in plasma during the deep dive (Rocco et al., 2019; Grover et al., 2014; Lowry, 2002).
- Stimulating the libido with the lack of oxygen in autoerotic maneuvers (Gowitt et al,. 2019).
- Voluntary inhalation of inert gas from separate container for suicidal purposes (Madentzoglou et al., 2013; Byard et al., 2019; Brett et al., 2008).
- In this case study a 47-yr-old man committed suicide with a handmade device: A breathing tent made from a plastic water bag clung to his neck and that covered his face, connected by a hose to a valve of a large industrial nitrogen gas cylinder.

The hypothesis of suicide in the case reported seems to be confirmed by the following facts:

- Use of the full-face homemade device fixed to the occipital region of the head by a lot of scotch tape, thus ensuring continuous inhalation of pure nitrogen despite the victim's loss of consciousness.
- No evidence is attributable to sexual paraphilia, his nudity can be explained by the high temperature in the apartment due to the radiator on.
- History of depression (several prescriptions for psychiatric antidepressant drugs).
- Suicide attempt in the previous months.
- Recent separation and complaint for stalking by his wife, later learned from his parents.
- No sign of forced entry at the door.

The effects of exposure to respiratory mixtures are complex and have been attributed to several biochemical mechanisms.

Rostain, et al., (2016) propose two major theories: the lipid theory and the protein theory (Rostain et al., 2016). The lipid theory suggests a direct correlation between the affinity of an inert gas for membrane lipids and its narcotic power, while the theory of proteins predicts the binding of gas molecules to membrane proteins or receptors.

Besides, recent studies have shown how nitrogen affects the basal ganglia who are implicated in the regulation of motor, locomotor, and cognitive processes.

The main structures of the ganglia (striatum and substantia nigra) are modulated by glutamatergic excitatory afferents from the prefrontal cortex of thalamus to the nucleus striatum (Albin et al., 1989) and from the subthalamic nucleus to the substantial-nigra, acting on the NMDA receptor of dopaminergic neurons (Albers et al., 1999; McLeod et al., 1988; Wedzony et al., 2001).

McLeod, et al., (1988) made the first study which demonstrated by following exposure of some rats to a mixture of nitrogen and oxygen the release of neurotransmitters of norepinephrine and dopamine in the caudate nucleus and in the hypothalamus. In this study dopamine levels in the striatum were considered as an index of the changes induced by exposure to different concentrations of inert gases (Albin et al., 1989).

These levels were subsequently assessed in the Forni & Rostain (1989) study by in vivo implantation of a dopamine-sensitive multifiber carbon electrode in the striatum of a rat (in order to assess levels following inert gas exposure) (Forni et al., 1989).

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These rats were exposed to 3.1 MPa of nitrogen-oxygen mixture and recorded a level of striatal dopamine decreased by up to 20% [40], which was associated with a 50% decrease in motor skills and alertness (Turle et al., 1998; Turle-Lorenzo et al., 1999).

Conversely, an increase in striatal dopamine levels was appreciated with the exposure of rats to helium under pressure (Forni et al., 1989; Abraini et al., 1991; Abraini et al., 1998; Rostain et al., 1995).

To sum up, the decrease in striatal dopamine levels induced by nitrogen exposure may be related to the properties of the inert gas in sè.

Besides, in vivo experiments by applying probes at the level of the striatum on free-moving rats showed both a decrease in glutamate and an increase of serotonin levels (Forni et al., 1989).

Furthermore, nitrogen asphyxiation is also considered as a more euthanasia method (Creque, 1995).

Since 1980 to 2003 there was in America the "Hemlock Society", an American right-to-die and assisted suicide advocacy organization, who provide to inform about various suicidal modes with the emblematic slogan "Good life, good death" (Kamakahi et al., 2001).

The Hemlock Society's primary mission included providing information to the dying and supporting legislation permitting physician-assisted suicide. One of the proposed suicidal modalities is nitrogen-induced asphyxia.

In 2018 the founder of "Exit International Association" presented a controversial suicide pod called "Sarco" (short for sarcophagus), a 3D-printed machine invented by Australian euthanasia activist.

Sarco comes with a detachable coffin, mounted on a stand that contains a nitrogen canister, the person who wants to die should presses the button and the capsule is filled with nitrogen.

Manufacturers assure "He or she will feel a bit dizzy but will then rapidly lose consciousness and die".

Definitely inhalation of nitrogen causes a rapid reduction of oxygen molecules at the level of the alveolar-capillary membranes of the lungs. The reduction of oxygen in gas exchanges causes a state of hypoxemia, a condition with low oxygen content in the blood.

Anyway, after a few breaths the alveolar spaces become completely filled with pure nitrogen, and hence, the fatal asphyxia of the victim develops. Death from suffocating gases is caused not by their toxicity, but because of displacement of oxygen by the breathed gas mixture (Auwarter et al., 2004; Howard et al., 2011; Zivkovic et al., 2010; Watanabe et al., 1998).

CONCLUSION

In conclusion, since suffocating gases do not leave specific autopsy findings and nitrogen is a normal constituent of the blood gases, postmortem toxicological studies could be inefficacious to determine the cause and manner of death. In a case involving nitrogen gas inhalation there is the need of thorough investigations of the scene as well as of the circumstances surrounding the death (Moskowitz (n.d.); Auwarter et al., 2004; Rocco et al., 2019; Grover et al., 2014; Lowry, 2002; Gowitt et al., 1992; Madentzoglou et al., 2013; Byard et al., 2019; Brett et al., 2008; Auwarter et al., 2004; Gilson et al., 2004; Benevento et al., 2021) evaluating also a creative way to commit suicide (Benevento et al., 2021; Kyaga et al., 2013; Bryan et al., 2019).

However as emerged from subsequent computer analyses on the victim's laptop, he had done several internet researches on the effects of nitrogen inhalation.

The unanswered question still remains concerning the solved Rubik's cube besides the body.

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REFERENCES

Abraini, J.H., & Rostain, J.C. (1991). Pressure-induced striatal dopamine release correlates hyperlocomotor activity in rats exposed to high pressure. *Journal of Applied Physiology, 71*(2), 638-643.

Abraini, J.H., Rostain, J.C., & Kriem, B. (1998). Sigmoidal compression rate- dependence of the narcotic potency of inert gases in rats: Implication for lipid *vs* protein theories of inert gas action in the central nervous system. *Brain Research, 808*, 300-304.

Albers, D.S., Weiss, S.W., Iadarola, M.J., & Standaert, D.G. (1999). Immunohistochem- ical localization of N-methyl-D-aspartate and alpha-amino-3-hydroxy- 5-methyl-4-isoxazolepropionate receptor subunits in the substantia nigra pars compacta of the rat. *Neuroscience, 89*, 209-220.

Albin, R.L., Young, A.B., & Penney, J.B. (1989). The functional anatomy of basal ganglia disorders. *Trends in Neurosciences, 12*(10), 366-75.

Auwarter, V., Pragst, E., & Strauch, H. (2004). Analytical investigations in a death case by suffocation in an argon atmosphere. *Forensic Science International, 143*, 169–75.

Benevento, M., Mandarelli, G., Ferorelli, D., Trotta, S., Bottari, G., Caterino, C., & Solarino, B. (2021). Complex suicide by drowning and self-strangulation: An atypical "holy" way to die. *Forensic Science International: Reports, 3*, 100190. Brett, E., & Barbara, W.C. (2008). Case report of suicide by inhalation of nitrogen gas. The *American Journal of Forensic Medicine and Pathology, 29*(3), 235-237.

Bryan, C.J., Vujanovic, A.A., & Nock, M.K. (2019). Innovations in the science of suicide. *Behaviour Research and Therapy*, 103451.

Byard, R.W., Winskog, C., & Heath, K. (2019). Nitrogen inhalation suicide pacts. *Medicine, Science and the Law, 59*(1), 57-60.

Carfora, A., Campobasso, C.P., Cassandro, P., La Sala, F., Maiellaro, A., Perna, A., Petrella, R., & Borriello R. (2019). Fatal inhalation of volcanic gases in three tourists of a geothermal area. *Forensic Science International.*

Carfora, A., Petrella, R., Borriello, R., Aventaggiato, L., Gagliano-Candela, R., & Campobasso, C.P. (2021). Fatal poisoning by ingestion of a self-prepared oleander leaf infusion. *Forensic Science, Medicine and Pathology, 17*(1), 120-125.

Cascella, M., Rajnik, M., Cuomo, A., Dulebohn, S.C., & DiNapoli, R. (2020). Features, evaluation and treatment coronavirus (COVID-19). In: StatPearls. Treasure Island (FL): StatPearls Publishing.

Creque, S.A. (1995). Killing with kindness – capital punishment by nitrogen asphyxiation. *National Review, 47*(17), 51.

Davis, J.L., Schirmer, J., & Medlin, E. (2018). Pharmacokinetics, pharmacodynamics and clinical use of trazodone and its active metabolite m-chlorophenylpiperazine in the horse. *Journal of Veterinary Pharmacology and Therapeutics, 41*(3), 393-401.

Dunmore, R. (2020). Coronavirus-related suicides surface amid increased anxiety. Newsone.

Feola, A., Cassandro, P., Carfora, A., Petrella, R., Giordano, C., & Stefanizzi, I.M. (2017). Suicides in physicians: two cases of poisoning involving fentanyl and phenobarbital. *Minerva Psychiatry, 58*,103–109.

Forni, C., & Rostain, J.C. (1989). Effect of helium-oxygen pressure on dopamine detected in vivo in the striatum of hamsters. *Journal of Applied Physiology, 67*, 1617- 1622.

Gilson, T., Bruce, O.P., & Porterfield, C.M. (2003). Suicide with inert gases – addendum to final exit. *The American Journal of Forensic Medicine and Pathology*, 24, 306–8.

Goeringer, K.E., Raymon, L., & Logan, B.K. (2000). Postmortem forensic toxicology of trazodone. *Journal of Forensic Science, 45*(4), 850-856.

Gowitt, G.T., & Hanzlick, R.L. (1992). Atypical autoerotic deaths. *The American Journal of Forensic Medicine and Pathology, 13*(2), 115-9.

Grattagliano, I., Ostuni, A., Marrone, M., Cassano, A., Tafuri S, Bianchi F.P., & Catanesi, R. (2019). The wish 'not to be'. Survey of suicide cases arriving at the Prosecutor's Office of the Court in Bari in the years 2014-2016, *170*(1).

Gregory, S. (2009). Origin of the terms Pnictogen and Pnictide. *Journal of Chemical Education, 86*(10), 1200.

Grover, C.A., & Grover, D.H. (2014). Albert Behnke: Nitrogen narcosis. *The Journal of Emergency Medicine, 46*, 225–227.

Harding, B.E., & Wolf, B.C. (2008). Case report of suicide by inhalation of nitrogen gas. *The American Journal of Forensic Medicine and Pathology, 29*, 2357.

Howard, M.O., Hall, M.T., Edwards, J.D., Vaughn, M.G., Perron, B.E., & Winecker, R.E. (2011). Suicide by asphyxiation due to helium inhalation. *The American Journal of Forensic Medicine and Pathology, 32*(1), 61–70.

https://www.exitinternational.net (last access 11/05/2021)

Kamakahi, J.J., Cossman, J.S., & Fox, E. (2001). The right-to-die movement: Extrapolating from the National Hemlock Society U.S.A. membership survey. *Omega (Westport), 43*(1), 7-23. Kessler, R.C., Merikangas, K.R., & Wang, P.S. (2007). Prevalence, comorbidity, and service utilization for mood disorders in the United States at the beginning of the twenty-first century. *Annual Review of Clinical Psychology, 3*,137-58.

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Khouzam, H.R. (2017). A review of trazodone use in psychiatric and medical conditions. *Postgraduate Medical Journal, 129*(1), 140-148.

Kohn, R., Saxena, S., Levav, I., & Saraceno, B. (2004). The treatment gap in mental health care. *Bull World Health Organ, 82*(11), 858-66.

Kyaga, S., Landén, M., Boman, M., Hultman, C.M., Långström, N., & Lichtenstein, P. (2013). Mental illness, suicide and creativity: 40-year prospective total population study. *Journal of Psychiatric Research, 47*(1), 83-90.

Lieberman, J.A., & Olfson, M. (2020). Meeting the mental health challenge of the COVID-19 pandemic. Psychiatric Times.]

Lowry, C. (2002). *Oxygen toxicity*. In: Edmonds C, Lowry C, Pennefather J, Walker R, editors. Diving and subaquatic medicine. (*4th edition*). London, U.K.: Arnold Publications, 207–22.

Madentzoglou, S., Anastasia, K.E., Despoina, N., Elena, K.F., & Manolis, M. (2013). Nitrogen–plastic bag suicide. *The American Journal of Forensic Medicine and Pathology, 34*(4), 311-314.

Maebashi, K., Iwadate, K., Sakai, A., Takatsu, K., Fukui, M., Aoyagi, E., Ochiai, T., & Nagai, T. (2011). Toxicological analysis of 17 autopsy cases of hydrogen sulfide poisoning resulting from the inhalation of intentionally generated hydrogen sulfide gas. *Forensic Science International, 207*, 91–95.

McLeod, M., Bennett, P.B., & Cooper, R.L. (1988). Rat brain catecholamine release at 1, 10, 20 and 100 ATA heliox, nitrox and trimix. *Undersea and Hyperbaric Med, 15*, 211-221.

Miller, J.R. (2020). British teen dies after suicide attempt due to coronavirus fears. New York Post.

Moskowitz, C. (n.d.). Space shuttle worker dies in fall at launch pad.

Ornell, F., Schuch, J.B., Sordi, A.O., & Kessler, F.H.P. (2020). "Pandemic fear" and COVID-19: Mental health burden and strategies. *Brazilian Journal of Psychiatry, 3*.

Parker, J.N., & Parker, P.M. (2004). Trazodone: A medical dictionary, bibliography, and annotated research guide to internet references. ICON Group Int. Inc, Las Vegas.

Patel, B.N., Sharma, N., Sanyal, M., & Shrivastav, P.S. (2008). High throughput and sensitive determination of trazodone and its primary metabolite, m-chlorophenylpiperazine, in human plasma by liquid chromatography–tandem mass spectrometry. *Journal of Chromatography B, 871*(1), 44-54. [SemanticScholar] [GoogleScholar] [Crossref]

Rocco, M., Pelaia, P., Di Benedetto, P., Conte, G., Maggi, L., Fiorelli, S., & De Blasi, R.A. (2019). Road project investigators. Inert gas narcosis in scuba diving, different gases different reactions. *European Journal of Applied Physiology, 119*(1), 247-255.

Rostain, J.C., & Forni, C. (1995). The effects of high pressures of various gas mixtures on rat striatal dopamine detected in vivo by voltammetry. *Journal of Applied Physiology, 78*, 1179-1187.

Rostain, J.C., & Lavoute, C. (2016). Neurochemistry of pressure-induced nitrogen and metabolically inert gas narcosis in the central nervous system. *Comprehensive Physiology, 6*(3), 1579-90.

Rupp, W.R., Thierauf, A., Nadjem, H., & Vogt, S. (2013). Suicide by carbon dioxide. *Forensic Science International, 231*, e30–e32.

Sher, L. (2019). Resilience as a focus of suicide research and prevention. *Acta Psychiatr Scand, 140*,169-180.

Sher, L. (2020). The impact of the COVID-19 pandemic on suicide rates, The Author(s) 2020. Published by Oxford University Press on behalf of the Association of Physicians. QJM.

Stemberga, V., Bralic, M., Bosnar, A., & Coklo, M. (2007). Propane-associated autoerotic asphyxiation: Accident or suicide? *Collegium Antropologicum, 31*, 625–7.

Straka, L., Novomesky, F., Gavel, A., Mlynar, J., & Hejna, P. (2013). Suicidal nitrogen inhalation by use of scuba full-face diving mask. *Journal of Forensic Sciences, 58*(5), 1384-7.

Turle, N., Saget, A., Zouani, B., & Risso J.J. (1998). Neurochemical studies of narco- sis: A comparison between the effects of nitrous oxide and hyperbaric nitrogen on the dopaminergic nigro-striatal pathway. Neurochemical Res, 14, 999-1005.

Turle-Lorenzo, N., Zouani, B., & Risso, J.J. (1999). Narcotic effect produced by nitous oxide and hyperbaric nitrogen narcosis in rats performing a fixed ratio test. *Physiology & Behavior, 67*, 321-325.

Watanabe, T., & Morita, M. (1998). Asphyxia due to oxygen deficiency by gaseous substances. *Forensic Science International, 96*, 47–59.

Wedzony, K., Czepiel, K., & Figal, K. (2001). Immunohistochemical evidence for localization of NMDAR1 receptor subunit on dopaminergic neurons of rat substantia nigra pars compacta. *Polish journal of pharmacology, 345*, 523-529.

Zalar, B. (2018). Suicide and suicide attempt descriptors by multimethod approach. *Psychiatria Danubina, 30*(3), 317-322.

Zivkovic, V., Jukovic, F., & Nikolic, S. (2010). Suicidal asphyxiation by propane- butane mixture inside a plastic bag: Case report. *Srpski Arhiv Za Celokupno Lekarstvo Standard Journal, 138*, 376–8.

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