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Death in the Dental Chair

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ABSTRACT: Death during dental anesthesia is relatively rare. Review of eight such cases which occurred in our county, including the different anesthetics used, revealed one apparent basic pattern that prevailed . . . a need for awareness that something might go wrong and recognition of the fact that it *was* going wrong.

KEYWORDS: odontology, death, anesthetics

Pain is the most common factor that induces a patient to seek dental care. The patient arrives filled with anxiety and fear. The dentist must diagnose the problem, check the health history, and weigh the risks of treatment. Depending on his experience, the medical history, and age of the patient, the dentist must choose an anesthetic to deal with the pain. He may choose an analgesic agent which will cause loss of pain sensation without loss of consciousness, an anesthetic which causes insensibility to pain without loss of consciousness, or an anesthetic which renders the patient unconscious [*1*]. We will refer to this latter state of unconsciousness when referring to general anesthesia.

In 1771 Joseph Priestly discovered oxygen and then one year later nitrous oxide [*1*]. Horace Wells, a dentist, saw a demonstration of nitrous oxide anesthesia involving a young man who did not realize that his leg was bleeding or that he had pain. Wells, excited by this discovery, persuaded his friend, Dr. Riggs, to extract his tooth while he, Wells, was under the influence of nitrous oxide. Such was the beginning of the use of general anesthesia. This was followed by the discovery that in certain procedures it was necessary to add narcotic analgesics, ultrashort-acting barbiturates intravenously, other inhalation agents, or local anesthetic injections to elevate the pain threshold [*2*].

Search of the files of the Cuyahoga County Coroner's office, which serves greater Cleveland, revealed that there had been eight "dental" deaths over the seventeen-year span, 1970 through 1987. Six of the deaths occurred in private dental offices and two in a hospital setting. Five deaths occurred with the patient under general anesthesia, one with nitrous oxide, one with the local anesthetic xylocaine®, and one with chloral hydrate. The patients ranged in age from three to sixty-four.

The population of Cuyahoga County in 1980 was approximately one and one half million. The eight deaths in seventeen years during dental anesthesia give an average annual mortality rate of about 1:3 000 000 people. This is not exact since the population of the county was greater in 1970 (1 721 300), and between 1970 and 1979 there were four deaths making the chances of dying from dental anesthesia even smaller (1:4 300 000). Reliable national esti-

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mates of mortality associated with the use of general anesthesia and sedation in the dental office are not available for the United States [3]. Lytle and Yoon [4], who produced figures for mortality based upon the number of general anesthetics administered, restricted their survey to a group of selected oral surgeons who belonged to the Southern California Society of Oral and Maxillofacial Surgeons (SCSOMS). Their figures have been used to represent mortality rates for the nation. Their survey was done by questionnaire and did not include other dentists in the community. Another problem arises from the fact that reporting of these types of therapeutic misadventures to the coroner is not required and so data may appear lower than it is. Our statistic is based on actual deaths for the entire county. Although the county population has decreased over the seventeen-year span, it should be kept in mind that the number of practicing dentists has increased and the number of people seeking dental care has also increased. Also worth noting is the fact that the chance of dying from accidental electrocution is fifteen times greater than the chance of dying from dental anesthesia, yet no one worries about the hazards of plugging in a lamp [5].

Because of the foregoing comparatively slight risk, very few, if any, people think of dying in the dental chair. What details or features were present or overlooked in the eight cases which produced the aforementioned results? These details could provide us with an opportunity to learn and thus hopefully avoid further tragedies.

In 1971 three deaths occurred during extractions in persons under general anesthesia with Brevital®. Inadequate oxygenation and excessive medication were reported as the cause of death. Cardiac arrest was the mechanism. All three decedents had histories of hypertensive cardiovascular disease. Brevital is an ultrashort-acting barbiturate with a fast onset of action; however, it does have a low therapeutic index and it should be used only where the facilities and staff can provide meticulous monitoring [6]. The selection of drug and technique depends on several factors: the patient's medical background or condition, the dental procedure and its requirements for pain reduction, patient cooperation, and the dentist's and staff's ability to handle adequately the anesthesia and possibly an emergency arising during its use. A history of hypertensive cardiovascular disease warrants a statement from the patient's physician as to the former's ability to tolerate general anesthesia. Moreover, Brevital is a profound respiratory depressant. If the patient is resistant and more anesthetic is considered necessary, nitrous oxide-oxygen plus the stronger sedative diazepam (Valium®) or analgesic meperidine (Demerol®) should be used.

As indicated earlier, nitrous oxide used in conjunction with meperidine and diazepam accounted for one fatality, a thirty-year old man. Nitrous oxide-oxygen (N_2O-O_2) in 30 to 50% N_2O concentration (without other agents) is ordinarily mildly sedative. When the concentration approaches 80%, the patient may "slide" into anesthesia [1]. Meperidine, a narcotic, can cause respiratory depression or arrest, and diazepam, in sedative doses, abolishes laryngeal reflexes in 4% of patients. The difference between general anesthesia and light conscious sedation is dependent on dosage, the health of the patient, the combination of drugs administered, the rapidity of administration, and so forth [7]. Careful monitoring and operator's awareness of small changes in the patient's response to the drug can make a life-and-death difference. Death in this tragedy was attributed to acute intoxication by the combined action of the drugs: nitrous oxide, meperidine, and diazepam.

Malignant hyperpyrexia is another hazard with N_2O we have not encountered in our Cuyahoga County study population. Susceptible patients, who carry the autosomal recessive trait, are sensitive to certain general anesthetics and depolarizing muscle relaxants which can cause muscle contractions, acidosis, and hyperpyrexia. The latter is extremely rare but is a life-threatening situation. Nitrous oxide has general anesthetic properties, and therefore careful questioning before administering and careful monitoring thereafter should protect the patient from potential hazard [7].

It has been estimated that 50 million cartridges of local dental anesthetics are administered annually in the United States with relative safety and few complications [8]. We en-

countered one death following Xylocaine injection in a twenty-two year old woman. The two main untoward responses to local anesthesia arise from toxic overdose or hypersensitivity. The toxic overdose may first elicit stimulation of the central nervous system which can range from anxiety and nausea to convulsions. The more severe this phase, the deeper is the depression in the second phase. The dentist must be aware of the fact that if the patient goes into convulsions, the next phase may be lethal respiratory arrest. The maximum safe dose of 2% Xylocaine with 1:100 000 epinephrine for the average patient (weight 120 lbs [54 kg] is ten cartridges. If no epinephrine is used, twelve cartridges may be administered [*9*]. The operator-dentist did not exceed this safe level. The patient expired 12 min following injection as a result of irreversible syncope, probably caused by hypersensitivity (that is, anaphylaxis). The patient convulsed in the dental chair, and there was a question as to how well she had been oxygenated during her convulsive state. An effective therapeutic agent for controlling convulsions would have been Valium administered injected intravenously or sublingually. This had not been done. Since the local anesthetic is a respiratory depressant, resuscitative equipment *must* be immediately available. In addition, at the time of this death in 1973, most dentists and physicians were unaware of the hazards of preservatives such as sodium bisulfite that were added to the anesthetics, and the patient's anaphylaxis may have been due to an allergy to the bisulfite and not to the Xylocaine itself. Today a question to be asked in addition to all the others is "Are you allergic to sulfa drugs?"

The final death in our study population was a three-year-old boy to whom chloral hydrate had been administered orally 20 to 30 min earlier. Chloral hydrate has a fairly short duration of action ~4 h. It is relatively safe with a child's dosage for sedation with 8 mg per kilogram of body weight or for somnolence with 50 to 100 mg per kilogram of body weight [*10*]. The child weighed 17 kg and was given at least five teaspoons of chloral hydrate (500 mg/5 mL, 1 tsp = 5 mL), a dose of 2500 mg. The dentist made several mistakes over and above the administration of an excessive dose. Although the child was unconscious after the dental procedure had been completed, he was nevertheless dismissed from the office. The doctor was not alert to the fact that "something was going wrong." Strict supervision and monitoring of the patient would have informed the operating dentist that all was *not* well, and the initiation of action may have saved the child's life.

Conclusion

Review of these eight cases reveals that the more complex the dental therapy and the deeper the general anesthesia needed, the greater is the risk. Sedation by a dentist is usually safe, but a sensitive awareness and careful monitoring of vital signs are essential. In addition, careful attention to health histories and evaluation of the necessity for a particular anesthetic will help avoid misfortune.

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References

[*1*] Stuebner, E. A., "Nitrous Oxide—Analgesia or Anesthesia," *Dental Clinics of North America*, Vol. 17, No. 2, April 1973, pp. 235-247.

[*2*] Goldman, V., "Death in the Dental Chair," *Medicine, Science and the Law*, Vol. 13, No. 1, Jan. 1973, pp. 39-45.

[3] "Anesthesia and Sedation in the Dental Office," NIH Consensus Development Conference, 22-24 April 1985.
[4] Lytle, J. J. and Yoon, C., "1978 Anesthesia Morbidity and Mortality Survey: Southern California Society of Oral and Maxillofacial Surgeons," *Journal of Oral Surgery*, Vol. 38, Nov. 1980, pp. 814-819.
[5] *Statistical Abstract of United States 1987*, 107th ed. U.S. Bureau of Census, 1987.
[6] Trieger, N., "Intravenous Sedation," *Dental Clinics of North America*, Vol. 17, No. 2, April 1973, pp. 249-360.
[7] Duncan, G. H. and Moore, P., "Nitrous Oxide and the Dental Patient. A Review of Adverse Reactions," *Journal of the American Dental Association*, Vol. 108, Feb. 1984, pp. 213-219.
[8] Kramer, H. S. and Milton V. A., "Complications of Local Anesthesia," *Dental Clinics of North America*, Vol. 17, No. 3, July 1973, pp. 443-460.
[9] Terezhalmy, G. T., Bowen, L. L., and Rye, L. A., "Pharmacotherapeutics in Urgent Dental Care," *Dental Clinics of North America*, Vol. 30, No. 3, July 1986, pp. 399-418.
[10] *Professional Guide to Drugs*, L. N. Gever, Ed., Intermed Communications, Horsham, PA, 1981.

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