causes an erosion with subsequent ulceration and extravasation. With time, there is a granulomatous formation with or without a localized periurethral abscess. If correction is begun at this time, only a severe urethral stricture may result. However, it is also possible to have an ischemic gangrene of the penis severe enough to require amputation. Sepsis is a predominant accompanying finding. If adequate treatment is instituted, the patient usually recovers, but four deaths were reported in the questionnaires from periurethral infection and septicemia.

Comment

The use of the urinary retention catheter is a medical necessity which too often is accompanied by traumatic injuries that have the potential for serious local sequelae and even death. Most of the physicians in the survey were aware of the problem, but there were others who even questioned that such an event could happen. The positive replies to the questionnaire repeatedly implicated medical students, paramedical personnel in nursing homes, and the physician who only occasionally inserts Foley catheters, as the chief initiators of this serious sequence of events.

Since this study began, a verbal query of medical students, interns, and residents in numerous hospitals indicates a universal need for them to have a course of instruction similar to the one used by the schools of nursing for many years. Just as important is a training program for the paramedical personnel who in the future will be inserting more and more of the indwelling catheters. The true incidence of catheter balloon injuries is not known, but this review strikingly demonstrates the existence of a serious problem.

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LSD 2193

Extreme Hyperthermia After LSD Ingestion

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Hyperthermia is a known effect of lysergic acid diethylamide (LSD). This is, to our knowledge, the first recorded instance of life-threatening hyperthermia (106.4 F [41.3 C] axillary) in man, following the use of LSD, and may have been dose-related. The hyperthermia was rapidly reversed by alcoholic-ice soaks, hallucinations ended about 18 hours later, and the patient recovered without obvious mental or physical injury.

LYSERGIC acid diethylamide (LSD) was first synthesized in 1938. Its well-known psychotomimetic properties were first noted in 1943 and described in 1947.[1] Its less well-known hyperthermic effects were first suspected in 1951[2] and definitely confirmed in 1954.[3] In all human studies to date, the temperature elevations have been relatively low-grade and never life-threatening. The purpose of this report is to describe a patient in whom extreme hyperthermia occurred following the use of LSD.

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Report of a Case

An 18-year-old white man was brought to the Philadelphia General Hospital by police who had found him behaving hysterically. No history was available upon admission.

On physical examination the patient was noted to be hallucinating and extremely hyperactive, necessitating restraints. Blood pressure was 160/100 mm Hg; pulse rate 160 beats per minute; and respirations, 48 per minute. Because of struggling, axillary temperature, rather than oral or rectal, was taken and noted to be 106.4 F (41.3 C). This was confirmed with a second thermometer. The skin was quite warm and slightly moist with perspiration. The pupils were slightly dilated and reacted to light directly and consensually. The patient was unresponsive to verbal stimuli but reacted to painful stimuli with increasing hyperactivity. The remainder of the physical examination was essentially unremarkable.

Treatment was initiated immediately. Towels soaked in an alcohol-ice mixture were applied to the entire body except the face, and frequently exchanged as they warmed. A fan was directed at the patient's body. Aspirin, 1,200 mg, was given rectally, as well as intravenous treatment with lactated Ringers injection.

Thirty minutes later the patient's axillary temperature measured 103.4 F (39.7 C), and chlorpromazine, 25 mg, was given intramuscularly. After another 20 minutes the patient's hyperactivity had slowed enough so that a rectal temperature of 104.8 F (40.4 C) could be obtained. Ten minutes later the rectal temperature was 103.0 F (39.4 C), the patient was still hallucinating but no longer hyperactive, and the alcohol-ice soaks were discontinued. After another 75 minutes his rectal temperature was 99.6 F (37.5 C) and remained subsequently within 1.2 F (0.7 C) of this. Although fever and hyperactivity had disappeared at this time (two hours and 15 minutes after admission), the patient continued to hallucinate.

Over the next ten hours he received 4,000 ml of 5% dextrose in water intravenously with 50 gm of mannitol. During this time he urinated 2,600 ml. Following this, about

12 hours after admission, treatment was ended since the patient had begun to appear more normal mentally. Six hours later he was thought to be "just about normal" by his parents and brother. The patient remained in the hospital for 36 more hours and then left against medical advice.

Results from admission laboratory tests were unremarkable except for a leukocytosis (23,360 cu mm), neutrophilia (86%), and low-grade elevations of the lactic dehydrogenase, glutamic oxaloacetic transaminase, uric acid, and blood glucose values. These values were all normal or almost normal when repeated 36 hours later and were likely related to either the hyperthermia or adrenergic activity.

While hospitalized the patient revealed a six-month history of intermittent usage of LSD, marijuana, amphetamines, and barbiturates. He claimed that about three or four hours preceding hospitalization he had ingested a "large" amount of LSD and only LSD. After that he recalled starting his "trip" and then nothing until after his fever had disappeared.

Following discharge, the patient was seen twice over the next six months in the Psychiatry Clinic and appeared to be physically and mentally all right. He had given up LSD.

Comments

Since 1963 it has been postulated that hypothalamic release of epinephrine, norepinephrine, and serotonin is responsible for temperature regulation. According to this monoamine theory, epinephrine and norepinephrine release lowers previously elevated (but not subnormal) temperature, while serotonin release raises temperature. A delicate balance in the release of these monoamines maintains normal body temperature.[4] Refinements to this theory have been made.[5-8]

LSD structurally is an elaboration of the basic serotonin molecule, and may be regarded as a 4-substituted dimethyltryptamine derivative. The characteristic effects of 4-substituted dimethyltryptamines include hyperthermism.[9] It is possible that LSD may interact or interfere with serotonin in vivo by still incompletely understood mechanisms. LSD can be a powerful serotonin antagonist in vitro.[1,9]

The hyperthermic effects of LSD have been documented.[1,3,9-11] Under experimental conditions the hyperthermic and psychotomimetic effects of LSD may be pharmacologically separated, with the psychotomimetic effects being viewed as norepinephrine-mediated and the hyperthermic effect as serotonin-mediated.[10,12]

The hyperthermic effects of LSD in man may be dose-related just as they are in animals, where large amounts of LSD can produce fatal hyperthermia.[10] Since some illicit users of LSD are searching for a "higher trip" and are willing to ingest many times the "usual" 400μg dose, extreme hyperthermia in man is not a totally unexpected result.

Rapid cooling of excessively high body temperatures with alcohol-ice soaks while carefully monitoring the body temperature, as in the present case, appears to be satisfactory treatment. Here normothermia was achieved within two hours after commencing treatment, and no significant hypothermia occurred. Antipyretic drugs probably do not counteract the hyperthermia, but pentobarbital sodium anesthesia can.[3] Phenothiazines following LSD ingestion probably would not have significant central hypothermic actions, although they could inhibit peripheral shivering and cause vasodilatation.[11]

Dr. Friedman is the recipient of a fellowship from the University of Pennsylvania Plan to Develop Scientists in Medical Research.

Nonproprietary and Trade Names of Drug

Chlorpromazine—*Thorazine*

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