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The Problem of Psilocybin Mushroom Abuse

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1 We have reviewed the clinical features and management of 44 consecutive patients presenting to hospital over a 5 week period during an outbreak of ingestion of psilocybin containing mushrooms.
2 Patients presented to hospital usually because of dysphoric effects an average of 3.8 h after ingesting the mushrooms.
3 Mydriasis was present in 40 patients but fewer than half showed other sympathomimetic features – tachycardia, hypertension or hyperreflexia.
4 Twenty-three patients experienced nausea and vomiting.
5 Distortions of perception chiefly visual were frequent as were paraesthesiae and feelings of depersonalization.
6 The effects of the mushrooms were short-lived and had worn off within 12 h in all but one patient.
7 Inducing emesis did not appear to hasten recovery from the effects of the mushrooms.

Introduction

Psilocybin and psilocin were isolated in 1958 (Hofman *et al.*, 1958) from mushrooms which have been used over many centuries by Mexican Indians for religious purposes (Wasson, 1959). These compounds which have been classified as lysergic acid diethylamide (LSD)-like hallucinogens are members of a group of drugs which produce a characteristic syndrome in man consisting of changes in perception, mood, behaviour, autonomic function and somatomotor reflexes (Martin & Sloan, 1977). During the 1960's 'recreational' use (or abuse) of psilocybin containing mushrooms became widespread in North America (Pollock, 1975) and also in Australia (Hall, 1973; Southcott, 1974). Although psilocybin had been identified in the British species *Psilocybe semilanceata* (Benedict, Tyler & Watling, 1967; Mantle & Waight, 1969) it was not until 1976 that abuse of psilocybin mushrooms was reported in the United Kingdom (Carter, 1976) and it became a problem in the Tayside region of Scotland during the autumns of 1979 and 1980 (Peden *et al.*, 1981). During the autumn of 1981 the problem of psilocybin mushroom or 'magic mushroom' abuse has grown apace (Young *et al.*, 1982) and we have had the opportunity to carry out a prospective evaluation of such cases and their management.

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Patients and methods

In anticipation of a further outbreak of psilocybin mushroom abuse a questionnaire was drawn up based on our previous experience of the condition (Peden *et al.*, 1981). Questions were asked about the numbers of mushrooms ingested, where they were obtained and what other drugs if any had been taken. In addition details were requested of symptomatology, physical findings, aspects of the mental state examination and projected management of the patient. Patients admitted to hospital were reassessed prior to discharge.

Results

Forty-four patients (9 female, 35 male) presented to the Admissions and Emergency Department of Ninewells Hospital, Dundee, or the Casualty Department of Dundee Royal Infirmary between September 13, 1981, and October 17, 1981, because of the effects of magic mushroom ingestion. The mean age was 17.6 years (range 11–33 years) and 15 were school children while 18 were unemployed. Of 35 patients able to quantify it, a mean of 87 mushrooms per person had been ingested (range 8–300). Ten patients brewed the raw mushrooms up in boiling water and drank the resulting 'tea' while the remainder consumed raw mushrooms (in 4 cases after drying). Eight patients had also ingested alcohol (in 1 case a large quantity) while 1 had smoked marijuana and one took a number (not quantified) of mianserin tablets. The mean period between presenting to hospital and ingesting the mushrooms was 3.8 h (range 1–8 h).

Mushrooms had been gathered from 10 different public parks, the most popular being two golf courses. Mushrooms from these sites and from gastric contents were identified as *Psilocybe semilanceata* (Liberty Cap) (see Watling, 1973; Cooper, 1979).

Physical manifestations

Eleven patients had vomited prior to appearing at hospital while 12 others had experienced nausea and 9 patients experienced upper abdominal pain. Four patients had been incontinent of urine. Eight patients exhibited flushing of the face and neck and a patchy erythematous eruption on the upper trunk but these manifestations were usually short lived.

Ten patients had a tachycardia of >100 bpm and the mean pulse rate was 90.1 bpm (range 60–120). Seventeen patients were significantly hypertensive (diastolic BP $\geq$ 100 mm Hg) and mean BP was 145/94. One patient initially had a BP of 230/130 although this settled over an hour to 140/100 without treatment. Although patients with marked tachycardia tended also to be hypertensive there was no significant correlation between pulse and BP.

Pupillary size was classified as small, normal or dilated and 40 patients had dilated pupils with 11 showing a sluggish reaction to light and 3 unreactive to light.

Likewise deep tendon jerks were classified as sluggish, normal or hyperreflexic and 16 patients showed hyperreflexia.

Mental state

(a) *Behaviour and mood*

Seven patients were aggressive and uncooperative of whom one had smashed the television in his home and after being restrained by his father had, by repeated striking of his head against the floor, extensively bruised and lacerated his face. Five patients were restless and hyperkinetic while 2 were disorientated and ataxic when trying to walk. One patient had been found walking naked beside a railway line. While conscious level was normal in most subjects, 6 were drowsy but easily roused. Four patients were euphoric and making fatuous comments while 4 others who appeared fully conscious were withdrawn, uncommunicative and staring vacantly.

Twenty-six patients described their experience as frightening of whom three were crying and three patients were convinced that they were dying while one wanted to commit suicide.

(b) *Perception*

Abnormalities of perception were frequent. Thirty subjects suffered visual perceptual distortions which were chiefly heightened awareness of colour and a sensation of objects changing shape. Kaleidoscopic phenomena were also described and 4 had full blown hallucinations, 2 seeing ghost-like figures and 2 describing brightly coloured animals climbing over their bodies. Eleven patients noted a heightened awareness of sound with 1 person hearing voices and another guitar music. Disorders of tactile sensation and body image perception occurred in 16 patients and most commonly were manifested as tingling or paraesthesiae of the limbs or face while one subject felt that his lips and tongue were swelling and that he would be suffocated. One subject described vivid déjà vu phenomena.

Management

One patient had been given salt and water to drink at home by her parents but had not vomited. Paediatric ipecacuanha emetic mixture was administered to 29 patients and caused vomiting in all. Recognizable mushroom specimens were recovered from 7 patients. One subject who had initially been very disturbed was not seen until 7 h after ingesting an estimated 130 mushrooms at which stage the only residual abnormality was pupillary dilatation. The vomitus from this patient, however, contained many mushrooms.

Seventeen patients given ipecacuanha and 8 not given any emetic were subsequently considered sufficiently recovered to be sent home from the Emergency Department in the custody of a responsible adult (one patient given no treatment was extremely violent and aggressive and was taken into police custody). Twelve

patients given ipecacuanha and 6 given no treatment were admitted to hospital for observation. Of these all but one were fully recovered within 12 h and fit for discharge and the other was fully recovered by 24 h. There was a trend for patients seen later in the study to be discharged home while patients seen earlier were more likely to be admitted to hospital. Decisions on administration of ipecacuanha and hospital admission were at the discretion of the admitting physician and there was no discernible initial difference between patients given ipecacuanha and those not, nor was there any apparent difference in the rate of recovery between patients given ipecacunaha and those not.

Two patients were given intramuscular diazepam, one because of severe agitation and fright, and the other because of agitation and aggressive behaviour. In both cases the patients became much less agitated and then somnolent.

Patients did not receive follow up appointments after discharge but none returned to hospital with late phenomena such as 'flashbacks', panic attacks or psychotic episodes.

Discussion

Psilocybin mushroom abuse is a relatively new phenomenon in the United Kingdom. The initial clinical description centred on a 'hippy' group in Manchester (Hyde *et al.*, 1978) and 'hippy' mushroom festivals have also been reported in Wales (*Observer*, 1980). Psilocybin was found in *P. semilanceata* growing in Scotland in 1968 (Benedict *et al.*, 1968) and there have been previous case reports of small scale abuse of psilocybin mushrooms from Scotland (Mills *et al.*, 1979; Cooles, 1980). Ingestion of these mushrooms in Tayside was first noted in the autumn of 1979 and we became aware of the problem in 1980 (Peden *et al.*, 1981). During the past autumn however the problem has escalated and also occurred in other areas of Scotland (Young *et al.*, 1982) probably due to the wet autumn producing a large crop of mushrooms. The patients presenting to hospital represent the tip of the iceberg in that the practice of mushroom ingestion was very widespread amongst young people during the short period when the mushroom basidiomes were available. Mushrooms were usually taken by groups of young people (up to 15 in number) and when questioned patients usually stated that they had heard about the mushrooms from friends. Mushrooms were also being passed around in public houses. The vast majority of subjects therefore appear to have uneventful experiences and those presenting to hospital usually do so because of adverse effects (usually 'bad trips') or because their parents have become aware of the mushroom ingestion and therefore worried about the possibility of 'toadstool' poisoning. Large scale abuse of psilocybin containing mushrooms (*P. cubensis*) occurred during a wet spell in Australia in 1969 but because of frequent bad trips the scale of the problem rapidly decreased (McCarthy, 1972; Southcott, 1974).

Most of our patients could give a limited description of the Liberty Caps using adjectives such as small, brownish and pointed. Identification may have been facilitated by the recent publication of 2 illustrated guides to would-be mushroom users (Cooper, 1978; Release Collective, 1979) which were on sale in a popular

music shop in Dundee. Nonetheless it would be surprising if such patients did not accidentally also consume other mushroom species. Dried Liberty Caps contain 0.1–0.4% of psilocybin and rather less psilocin (Cooper, 1978; Margot & Watling, 1981) and hence since our patients consumed an average of about 80 mushrooms each the average dose of psilocybin will have been of the order of 8–32 mg higher than the usual doses given in 2 human volunteer studies using pure psilocybin (Isbell, 1960; Parashos, 1976–7) but similar to the range of doses given in a third study (Malitz *et al.*, 1960).

The most frequent physical effects seen in the present study were dilatation of the pupils, tachycardia, hypertension and facilitation of deep tendon reflexes. Mydriasis, tachycardia and hyperreflexia have been constant findings in previous reports (McCarthy, 1972; Hyde *et al.*, 1978; Mills *et al.*, 1979; Cooles, 1980; Peden *et al.*, 1981; Harries & Evans, 1981) and volunteer studies using pure psilocybin have also noted these features (Isbell, 1959; Hollister *et al.*, 1960; Malitz *et al.*, 1960). We also noted hypertension as a common finding and this has received little previous comment (Kvambe & Edinberg, 1979). Pure psilocybin also produces elevation of blood pressure in some subjects (Isbell, 1959; Hollister *et al.*, 1960). It has been suggested (Malitz *et al.*, 1960; Hollister, 1982) that tachycardia and elevation of blood pressure might be related to the anxiety produced by the experience, however the patients exhibiting tachycardia and hypertension in the present study were not necessarily those who were particularly anxious. It would therefore appear that the sympathomimetic effects are caused by the psilocybin content of the mushrooms.

Flushing of the upper trunk and face was seen in 8 patients and has been noted previously following ingestion of mushrooms (Hyde *et al.*, 1978) and pure psilocybin (Malitz *et al.*, 1960). Four patients were incontinent of urine and this has previously been described in a young child (Southcott, 1974). Symptoms of gastrointestinal upset were also prominent with nausea and/or vomiting occurring in 23 patients and 9 complaining of abdominal pain (this being the reason for hospital attendance in 2 cases). Nausea and vomiting with Liberty Caps has been noted previously (Peden *et al.*, 1981; Harries & Evans, 1981) and in a volunteer study with pure psilocybin 6 of 14 subjects noted nausea coming on about 30 min after taking the drug (Malitz *et al.*, 1960). In this latter study 3 subjects also complained of abdominal pain thus suggesting that the gastrointestinal symptoms produced by the mushrooms are also due to the psilocybin content. An alternative possibility is that patients with gastrointestinal symptoms have in fact accidentally also ingested other fungi such as *Inocybe* species which may cause such symptoms because of their content of muscarine-like compounds (Lampe, 1979).

Emotional alterations were frequent in the present group of patients and dysphoria was the commonest reason for presentation to hospital. Such frightening experiences or 'bad trips' have been previously noted with psilocybin mushrooms (McCarthy, 1972; Hyde *et al.*, 1979; Peden *et al.*, 1981) and with pure psilocybin (Malitz *et al.*, 1960; Parashos, 1976–7) but had been said to be uncommon (Pollock, 1975).

The various perceptual disorders noted in the present study are also typical of those noted during volunteer studies with pure psilocybin (Isbell, 1959; Hollister

et al., 1960; Malitz *et al.*, 1960; Parashos, 1976–7) and were mainly visual distortions and occasionally fully formed hallucinations. It is of interest that 2 patients described brightly coloured animals climbing over their bodies as this has previously been described in an Australian child (Southcott, 1974). Distortions of body image (depersonalization) and paraesthesiae are also well recognized with pure psilocybin (Isbell, 1959; Malitz *et al.*, 1960; Parashos, 1976–7), but have been described with psilocybin mushrooms infrequently (Peden *et al.*, 1981; Harries and Evans, 1981) and were in fact common in the present study perhaps because these effects were specifically sought. Other psychiatric manifestations which have previously been described such as prolonged psychotic episodes (Hyde *et al.*, 1979; Peden *et al.*, 1981) and 'flashback' phenomena and panic attacks (Peden *et al.*, 1981) were not seen in the present study.

The most troublesome feature of the psilocybin mushroom abuse syndrome is the alteration in behaviour which may be produced. This may be life threatening as with the patient who was walking beside a railway line and can make matters difficult if, as also occurred, patients behave in an aggressive or violent manner, making adequate assessment difficult.

In terms of management it appears that the majority of psilocybin mushroom takers have no ill effects and do not present to hospital. In the group of patients who do present to hospital the effect of the drug is often wearing off by the time the patient is seen and after a short period of observation the patient can be discharged home, preferably in the care of a responsible adult. Many of our patients underwent induced emesis with ipecacuanha (the mushrooms having previously been found to block standard gastric lavage tubes) as has been recommended (Lincoff & Mitchell, 1977). In the present study induced emesis did not appear to alter the period of observation required before patients were considered fit for discharge. In addition the stomach of one subject, who was almost fully recovered when vomiting was induced, contained large numbers of mushrooms some 7 h after ingestion, and it is therefore possible that when large doses are ingested the tolerence which is known to develop to psilocybin (Isbell *et al.*, 1961) can develop within the course of a single 'over' dose. This is also suggested by the fact that there was no obvious dose response relationship between number of mushrooms ingested and effects, and patients who had taken a comparatively small quantity were no less affected than those who had consumed a large number. We therefore conclude that unless there are unusual features which suggest that other potentially more toxic fungi may have been ingested, or perhaps if the patient is a young child in whom psilocybin toxicity can be severe (McCawley *et al.*, 1962) induced emesis is unnecessary and that when managing patients who are already agitated or disturbed this procedure may even be counter productive.

The majority of patients who were particularly agitated or distressed responded to reassurance, but diazepam was administered to 2 subjects and appeared to produce improvement, this having previously been recommended in the management of such patients who have taken LSD (Barnett, 1971).

The current study suggests that the potential for abuse presented by Liberty Caps and other psilocybin mushrooms in the United Kingdom is considerable. It is likely that other epidemics like the present one will occur, but physicians must also

be alert for the sporadic user particularly in the wake of a previous period of heavy use. The diagnosis may be suggested by the physical findings of flushing, tachycardia, hypertension, mydriasis and hyperreflexia while a variety of perceptual disorders may also be present. Disorders of mood are common and patients are likely to present during a 'bad trip'. When pressed the patient can usually give an adequate description of the mushrooms which have been ingested, and in most cases no active treatment is either necessary or desirable since the effects of the mushrooms are usually short lived. The main problems are created by the effects of the mushrooms on the patient's behaviour.

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