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ECSTASY-INDUCED BRAIN DEATH AND ACUTE HEPATOCELLULAR FAILURE: MULTIORGAN DONOR AND LIVER TRANSPLANTATION

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Background. **Ecstasy is a neurotoxic and hepatotoxic drug. Brain edema and fulminant hepatic failure are two of the most serious complications associated with the consumption of ecstasy. Acute ecstasy intoxication can transform a patient into an organ donor or a hepatic graft recipient.**

Materials and Methods. **In the last 5 years in our centers, we have had two multiorgan donors who died from ecstasy-induced brain edema and three patients who required urgent orthotopic liver transplantation for treatment of severe acute hepatocellular failure induced by this drug. We performed eight transplantations using the organs of these two brain-dead donors: one heart, one bipulmonary, three kidneys, one kidney-pancreas, and two livers.**

Results. **Toxicity caused by ecstasy was not observed in any of the eight patients who underwent transplantation. The clinical state and the graft function of the heart, two liver, renopancreatic, and three kidney recipients were normal for a follow-up period that ranged between 7 months and 4.5 years. The lung recipient died from multiorgan failure secondary to bilateral pneumonia 5 days after the transplantation, and one of the kidney transplant patients died as a result of intestinal lymphoma 6 months after transplantation. The three liver transplantations in the three patients with ecstasy-induced fulminant hepatic failure were performed successfully using orthotopic transplantation. These three recipients are asymptomatic and have normal-functioning hepatic grafts after follow-up of 3.5 years, 15 months, and 11 months, respectively.**

Conclusions. **The thoracic and abdominal organs of people dying from ecstasy intoxication can be viable for transplantation. The short- and medium-term survival of the graft and of the recipient have been similar to that of other organ donors. Urgent liver transplantation is an effective therapeutic option in patients with ecstasy-induced acute hepatocellular failure.**

People who die from acute intoxications are currently accepted as organ donors. Transplantations of organs obtained from patients who die from intoxication with acetaminophen, amanita phalloides, tricyclic antidepressants, barbiturates, benzodiazepines, cyanide, cocaine, ethanol, methanol, carbon monoxide, organophosphate, lead, rodenticides (brodifacoum), and trichloroethylene have been successfully performed (*1–7*).

Ecstasy is the name popularly given to 3,4-methylenedioxymethamphetamine (MDMA), a synthetic by-product of methamphetamine. Its production is illegal, and consumption is clandestine and fairly popular among youths (*8*). Its metabolism is hepatic, and it is eliminated by the renal route. It is a lipophilic substance with a short half-life of approximately 8 hr, and its effects depend on the individual metabolism. The consumption of MDMA can produce serious acute toxic effects (*8–10*). The toxic dose is unknown, and the serious toxic effects are frequently idiosyncratic (*11*). The exact mechanism of this intoxication is unknown. The main causes of death are cardiac arrhythmias, fulminant hepatic failure, multiorgan failure, and structural lesions of the central nervous system (*11–13*). It can induce encephalic infarcts, subarachnoid hemorrhages, cerebral venous sinus thrombosis, cerebral vasculitis, and brain edema (*14–19*). Brain edema has been described associated with acute severe hyponatremia and can evolve to brain death (*20–22*), as occurred in our two donors. Fulminant hepatic failure caused by ecstasy can benefit from liver transplantation (*11, 23*).

We present the results of transplantations performed from two multiorgan donors with ecstasy-induced brain death, a fact not previously published in the literature. We also present three liver transplantations in three patients with ecstasy-induced fulminant hepatic failure, and we analyze our results and those published in the literature.

CLINICAL CASES

Organ Donors Deceased Because of Ecstasy Intoxication

Donor 1. A 15-year-old woman without pathologic history of interest was admitted because of an episode of obnubilation and psychomotor agitation after ingesting 1.5 ecstasy tablets 8 hr earlier. Ten minutes after admission the patient suddenly presented areactive bilateral mydriasis and clinical signs of decerebration. She was intubated and connected to mechanical ventilation. The brain computerized tomography (CT) showed diffuse brain edema and subarachnoid hemorrhage. The blood biochemistry on admission included hyponatremia of 119 mEq/L and plasmatic osmolarity of 240 mOsm/L. She evolved to brain death 32 hr after hospital admission.

After the diagnosis of brain death, which was based on clinical criteria and the presence of persistent intracranial circulatory arrest, she was assessed as an organ donor. The electrocardiogram only showed sinus tachycardia at 110 beats a minute. The transthoracic echocardiograph was normal. The chest radiograph demonstrated an atelectasis in the right lung. The hemogram and the basic study of hemostasia were normal. The renal and hepatic biochemical profile was

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normal. The abdominal ultrasound showed normal liver, pancreas, and kidneys. The serology for hepatitis B (HBV) and C (HCV) virus and for human immunodeficiency virus (HIV) was negative. The donor remained hemodynamically stable throughout the period of admission. The removal of heart, liver, and kidneys for transplantation began 10 hr after the diagnosis of death. The macroscopic examination of all these organs was normal.

The autopsy was performed after the multiorgan removal. The most important findings were a massive brain edema with dilatation of lateral ventricles and punctiform diffuse hemorrhage of the whole encephalic mass and thrombosis of lateral venous sinuses. As regards the pulmonary parenchyma, there were signs of massive diffuse atelectasis and the presence of fatty emboli in the pulmonary vascular system. The toxicologic study of blood, urine, gastric juice, and vitreous humour presented levels of MDMA of 0.03, 0.23, 14.54, and 0.01 μg/mL, respectively. No other toxics were detected in these biologic fluids.

The heart was transplanted to a 65-year-old patient with chronic cardiac failure secondary to rheumatic myocardiopathy. The recipient did not present any medical or surgical complications during the 12 days of hospital admission. She received immunosuppression with azathioprine, cyclosporine, and prednisone. At 4.5 years after transplantation, the clinical state and cardiac function were normal, and she did not present any cardiological complication during this period.

The liver was transplanted in an elective manner to a 62-year-old patient with hepatocarcinoma in liver with posthepatitis C cirrhosis. The transplantation was performed without complications after a cold ischemia period of 5 hours. In the first 72 hr after transplantation, he presented a maximum alanine aminotransferase (ALT) of 263 UI/L, a maximum prothrombin ratio (PR) of 1.15, and a minimum production of bile of 410 mL/day. The hepatic biopsy performed 3 days after transplantation did not show significant alterations. He received immunosuppression with azathioprine, cyclosporine, and prednisone. He remained in the hospital for 16 days without complications, and on discharge the clinical state and hepatic function were normal. Two years after transplantation he required left suprarenalectomy because of metastasis of hepatocarcinoma, and after 4 years, resection of a new hepatocarcinoma in the graft. At 4.5 years after transplantation, the patient was clinically asymptomatic, with a normal-functioning hepatic graft.

The left kidney was transplanted to a 54-year-old patient with chronic renal failure (CRF) secondary to chronic pyelonephritis. The cold ischemia time was 18 hr. The renal graft presented immediate function with creatinemia of 88 μmol/L on the seventh day after transplantation. The recipient did not present any complications during the 13 days of hospital admission. She received immunosuppression with cyclosporine, prednisone, and mycophenolate. The creatinemia was 62 and 97 μmol/L in the 1st and 4th years after transplantation, respectively. After 4.5 years of follow-up, the clinical state and renal function were normal.

The right kidney was transplanted to a 27-year-old patient with CRF secondary to bilateral hydronephrosis as a result of vesicoureteral reflux. The cold ischemia time was 20 hr. The renal graft presented immediate function. He received immunosuppression with cyclosporine, prednisone, and mycophenolate. The patient died as a result of intestinal lymphoma with cerebral metastasis at 6 months after transplantation, with a normal-functioning renal graft (creatinemia of 115 μmol/L).

Donor 2. A 19-year-old woman without pathologic history of interest was admitted for reduction in the level of consciousness and disorientation after ingestion of alcohol and MDMA 8 hours earlier. On admission, the brain CT did not demonstrate encephalic lesion and there was hyponatremia of 131 mEq/L and plasmatic osmolarity of 263 mOsm/L. The toxicologic screening showed ethanol in serum of 2.4 mmol/L, and qualitative study of amphetamines in urine was positive. No other toxics were detected either in the blood or in the urine. Ten hours after admission, the serum sodium was 120 mEq/L. Five hours later the patient suddenly presented neurologic deterioration, coma, sinus tachycardia at 180 beats a minute with bigeminy, and respiratory arrest that required immediate intubation and mechanical ventilation. The brain CT showed diffuse edema in the posterior fossa. The lumbar puncture demonstrated clear CSF with normal proteins and glucose and without cells. The bacteriologic and virologic culture of the CSF was negative. She evolved to brain death 23 hr after the ingestion of MDMA.

After the diagnosis of brain death, which was based on clinical criteria and the presence of persistent intracranial circulatory arrest, she was assessed as an organ donor. The electrocardiogram showed a sinus rate of 90 beats a minute and ST-segment elevation of 1 mm in DII, DIII, and V2 to V6 and prolongation of the QT interval (0.56 sec). The transthoracic echocardiography presented an overall depressed contractility with an ejection fraction of the left ventricle of 38% together with basal medium posteroinferior dyskinesia and anterior septal akinesia. The creatine kinase and troponin T values were 310 UI/L and 0.138 μg/L, respectively. The chest radiograph was normal. The PaO_2 with FiO_2 of 1 was 579 mm Hg. The culture of bronchial secretions for bacteria and fungi was negative. The basic study of the hemostasia was normal. The renal, hepatic, and pancreatic biochemical profile was normal. The abdominal ultrasound presented normal liver, kidneys, and pancreas. The serology for HBV, HCV, and HIV was negative. The donor remained hemodynamically stable from the diagnosis of death until the beginning of organ removal. The removal of lungs, liver, pancreas, and kidneys for transplantation began 20 hours after the diagnosis of death. Twenty-five minutes after the beginning of the removal, the donor presented a sudden episode of ventricular tachycardia, followed by ventricular fibrillation and asystole, which was reversed after 6 minutes of advanced cardiac reanimation. She did not present any other medical or surgical complications during the removal. Macroscopically, all the organs that were to be transplanted were normal.

The autopsy was performed after the multiorgan removal. The encephalic mass was macerated and presented signs of diffuse edema. Multiple punctiform hemorrhagic suffusions were observed in the cardiac macroscopic examination, covering the whole thickness of the left ventricle, except the septum. In the microscopic examination, there were multiple disseminated foci of transmural interstitial hemorrhage in the left ventricle, which especially affected the subendocardial and subepicardial regions. In addition, the immunohistochemical study revealed the presence of isolated myocardial fibers with signs compatible with recent ischemia. The toxicologic study of urine was positive for amphetamines and

negative for tricyclic antidepressants, barbiturates, benzodiazepines, cannabis, cocaine, and opiates. The qualitative determination of MDMA in bile was positive.

The lungs were transplanted to a 53-year-old patient with emphysema and pulmonary hypertension in a very severe pretransplantation clinical situation. Twelve hours after transplantation, he presented fever, leukocytosis, and acute respiratory failure. The posttransplantation radiograph of thorax identified a left basal infiltrate, which subsequently evolved to a bilateral alveolar infiltrate. The bronchoscopy revealed purulent bronchial secretions and sutures without signs of ischemia; abundant polymorphonuclears and hyaline membranes appeared in the bronchial biopsy. All the hemocultures and all the microbiologic cultures of the bronchial aspiration were negative. He evolved to multiorgan failure and died on the fifth day after transplantation.

The liver was transplanted to a 63-year-old patient with a background of posthepatitis C cirrhosis and liver transplantation 3 months earlier, which had been complicated with a thrombosis of the hepatic artery. This second transplantation was performed without surgical complications, and the graft presented immediate function. She received immunosuppressive treatment with tacrolimus and prednisone. She was discharged from the hospital after 3 weeks with normal hepatic function. Forty-seven days after transplantation, the hepatic biopsy revealed hepatitis C recurrence and the serum HCV-RNA by polymerase chain reaction was 475,000 UI/mL. Seven months after transplantation, she had a PR of 1.25 and a mixed pattern of cytolysis and cholestasis (AST 88 UI/L, ALT 45 UI/L, γ-glutamyltransferase [GGT] 200 UI/L, alkaline phosphatase 323 UI/L, and total bilirubin 1.7 μmol/L).

The right kidney was transplanted to a 43-year-old patient with CRF secondary to IgA nephropathy. The cold ischemia time was 16 hr. The renal graft presented immediate function. The recipient did not present any medical or surgical complications during the 9 days of hospital admission. He received immunosuppression with tacrolimus, mycophenolate, and prednisone. Seven months after transplantation, the clinical state and the renal function were normal (creatinemia of 104 μmol/L).

A renopancreatic transplantation was performed on a 31-year-old patient with CRF caused by diabetic nephropathy. The cold ischemia time was 6 hours. He received immunosuppressive treatment with tacrolimus, mycophenolate, and prednisone. The recipient presented immediate diuresis after transplantation. He required insulinotherapy only in the first 24 hr after transplantation. Seven months after the transplantation, he presented normal glucemias and creatinemia of 106 μmol/L.

Liver Transplantation in Ecstasy-Induced Fulminant Hepatic Failure

Recipient 1. A 25-year-old woman was admitted because of abdominal pain, jaundice, and vomiting for 5 days after consumption of ecstasy. Her history included the consumption of designer drugs and oral contraceptive pills. On admission she had hepatocellular failure with PR of 6.5, cytolysis and cholestasis, and renal failure (creatinemia of 415 μmol/L). The serology for HIV was negative. The most frequent causes of fulminant hepatic failure were excluded. The HAV, HBV, and HCV serologies were negative. Despite the medical treatment, the clinical state worsened and she presented encephalopathy. An orthotopic liver transplantation was performed on the second day of admission. The liver of the recipient presented a submassive necrosis, predominantly from area 2, and subcapsular hematomas. The transplanted liver came from a 56-year-old donor who died of head trauma. The cold ischemia time was 4 hr and 20 min. She received immunosuppression with azathioprine, prednisone, and cyclosporine. The patient was admitted for 15 days, and on discharge the PR was 1 and the renal function normal (creatinemia of 106 μmol/L). Sixteen days after the transplantation, she presented a grade I acute rejection that did not require treatment. At 3.5 years after the transplantation, she was asymptomatic with a PR of 1.04 and discrete cholestasis (AST 17 UI/L, ALT 17 UI/L, alkaline phosphatase 285 UI/L, GGT 98 UI/L, and total bilirubin 0.3 μmol/L).

Recipient 2. A 17-year-old male with a history of consumption of ecstasy, cannabis, and alcohol at weekends for 5 months was admitted with toxic subacute hepatitis with grade II encephalopathy and coagulation disorders after consuming ecstasy a few days earlier. The HAV, HBV, HCV, and HIV serologies were negative. An orthotopic liver transplantation was performed 4 days after admission. The histologic study of the recipient's liver presented a submassive hepatic necrosis and an intense cholestasis. The hepatic graft came from a 58-year-old donor who died of head trauma. The cold ischemia time was 4 hr and 25 min. He received immunosuppression with tacrolimus and prednisone. In the first 72 hr after transplantation, he presented a maximum ALT of 654 UI/L and a maximum PR of 1.6. On the tenth day after transplantation, he presented an episode of acute rejection that was resolved by increasing the dose of immunosuppressive treatment. He remained in the hospital for 1 month without other important complications, and on discharge a pattern of cytolysis and cholestasis persisted. Fifteen months after transplantation, the patient was asymptomatic with PR of 1.15, AST 34 UI/L, alkaline phosphatase 333 UI/L, and normal figures for ALT, GGT, and total bilirubin.

Recipient 3. A 16-year-old woman with a background of sporadic consumption of designer drugs was admitted after presenting with two days of jaundice, hepatic failure with a PR of 9, and grade I encephalopathy after consumption of several ecstasy tablets. The HAV, HBV, HCV, and HIV serologies were negative. The clinical evolution was unfavorable. Orthotopic liver transplantation was performed using the standard technique without medical or surgical complications 2 days after admission. The histologic study of the recipient's liver presented lesions of massive necrosis, and the immunohistochemistry techniques did not detect reactivity for hepatitis B surface antigen or for hepatitis B core antigen. The hepatic graft came from an 80-year-old donor who had died of spontaneous intracerebral hemorrhage. In the donor, the hepatic function, the abdominal ultrasound, and the macroscopic appearance of the liver were strictly normal. The cold ischemia time was 5.5 hr. The recipient received immunosuppressive treatment with tacrolimus and prednisone. In the first 72 hr after transplantation, she presented a maximum ALT of 913 UI/L and a maximum PR of 1.9. The transaminases and the activity of the prothrombin progressively normalized. The patient was admitted for 27 days without important complications after transplantation. The recipient suffered from two episodes of moderate rejection in the second and eighth months after transplantation,

which were resolved by increasing the dose of immunosuppressive treatment. Subsequently, in the 10th month after transplantation, she was admitted to study a pattern of cytolysis and cholestasis (AST 85 UI/L, ALT 115 UI/L, GGT 198 UI/L, alkaline phosphatase 177 UI/L, and total bilirubin 3.9 μmol/L). Abdominal Doppler ultrasound showed a hepatic graft with normal structure, and the hepatic artery, portal vein, and suprahepatic veins were permeable. The hepatic biopsy revealed intense intracanalicular cholestasis and portal and parenchymatous lesions compatible with acute cholangitis. The serum HCV-RNA by qualitative polymerase chain reaction and the antigenemia and the cytomegalovirus culture were negative. The alteration of the hepatic function tests was corrected after adding mycophenolate to the immunosuppressive treatment. At 11 months after transplantation, she was asymptomatic with PR of 1.1 and the alteration of the hepatic enzymes persisted: AST 68 UI/L, ALT 102 UI/L, GGT 216 UI/L, and alkaline phosphatase 295 UI/L.

DISCUSSION

The recreational consumption of MDMA has increased over the last decade, above all among youths (*8*). The ingestion of small quantities of this drug can cause serious hepatic and encephalic lesions (*11*, *14–21*). The incidence of these neurologic complications is unknown and can provoke brain death in healthy young people. One of the most frequent causes of brain death in these patients is brain edema associated with severe hyponatremia (*20–22*) as occurred in our donors. Young women present a specific risk for the development of severe hyponatremia (*20–22*). Hyponatremia tends to be dilutional because of water intoxication or secondary to inadequate secretion of antidiuretic hormone (*20*, *24*). Thirteen cases of hyponatremia associated with the ingestion of MDMA have been published, eight of them with brain edema demonstrated by brain CT, three of which evolved to brain death (*20–22*). Systemic complications were, moreover, observed in two of the three cadavers, pulmonary edema in one (*20*), and pulmonary edema and hepatic necrosis in the other (*21*). In our experience, all the organs from our two donors were viable for transplantation with the exception of the lungs of one donor and the heart of another. That is to say that in these fatal cases the rest of the thoracic and abdominal organs may be scarcely or not at all affected, and they may be considered as potential donor organs and tissues for transplantation.

Two considerations are important in all donors who die from intoxications. Firstly, a specific assessment of the structural and functional lesions of the organs caused by the pathologies associated or concomitant with the cause of death is essential. Secondly, it is vital to rule out possible organic toxic lesions in progress in addition to the possibility of toxic action subsequent to the transplantation. This last phenomenon may occur when the toxic responsible for the death of the donor accumulates in the organs transplanted (*1*, *25*). For example, the transmission of intoxication due to tricyclic antidepressants has been described in the recipient of a liver from a donor who died from this intoxication (*25*). Ninety-five percent of MDMA consumed is eliminated in approximately 40 hr, and its toxic effects can therefore persist for 1 or 2 days after ingestion (*9*). In our two donors, the interval between the ingestion of ecstasy and multiorgan removal was 50 and 51 hr, respectively.

The assessment of donors who die from ecstasy intoxication should be performed on the basis of clinical (clinical history and physical examination), biologic, and morphologic parameters. It is important to search for all those systemic complications described in ecstasy intoxication, mainly in the heart, lung, and liver (*11–13*, *20*, *21*). In the cardiac evaluation, we should look for signs of ischemia or myocardial necrosis, such as those described in patients intoxicated by MDMA in relation to coronary spasm (*26*, *27*) and arrhythmias (*12*). Prolonged QT interval is a risk factor for the development of malignant arrhythmias and asystole in these donors (*28*). In our second organ donor who was not a heart donor, there was a prolongation of the QT interval and she presented malignant arrhythmias during the multiorgan removal; in the pathologic study, extensive cardiac structural lesions were observed. At a pulmonary level, we should investigate mainly the presence of edema, infarcts, and intraalveolar hemorrhages (*8*, *11–13*, *20*). In the hepatic evaluation, it is important to detect clinical signs (hepatomegaly or jaundice) in addition to analytical data (hepatic enzymes, ammonemia, and the coagulation factors of hepatic synthesis) suggestive of hepatotoxicity caused by ecstasy (*11*, *23*). The pretransplantation hepatic biopsy may be useful to confirm or rule out tissular damage caused by ecstasy. The renal complications described in MDMA consumers include acute renal failure, probably of multifactorial etiology (*29*). The possible causes of this acute renal failure include disseminated intravascular coagulation, rhabdomyolysis and, according to some authors, a possible direct nephrotoxic effect caused by ecstasy (*29*). Our donors did not present either disseminated intravascular coagulation or rhabdomyolysis. No case of chronic renal failure caused by consumption of ecstasy has been described (*30*). No type of pancreatic alteration has been described in the literature in relation to MDMA consumption (*8–13*).

Eight patients received transplantations from the organs generated by our two donors: one bipulmonary, one heart, three kidneys, one kidney-pancreas, and two livers. The pretransplantation evaluation of all these organs showed a strictly normal functional and morphologic pattern. None of the clinical symptoms described in MDMA intoxication was present in any of the recipients after transplantation. In six recipients, the clinical state and the function of the grafts were normal during the follow-up period. The cause of death in the two recipients who died was not related to ecstasy intoxication.

The heart transplantation was successful and at 4.5 years after transplantation the clinical state and the cardiac function of the recipient were normal. The cardiac donor had presented a strictly normal cardiac function throughout hospital admission. The bipulmonary transplantation was performed without surgical complications. However, in the first 24 hr after transplantation the recipient presented fever and respiratory failure secondary to bilateral pneumonia and renal failure, and he died of multiorgan failure on the fifth day after transplantation. No pulmonary complication had been observed in the donor during the pretransplantation evaluation of both lungs: pulmonary function, radiograph of thorax, and bronchial secretion culture. We believe that this result is not related to ecstasy. Our results with the four kidney transplantations were excellent. All the renal grafts had immediate function. One of the recipients died after 6 months

as a result of intestinal lymphoma with renal function preserved (creatinemia of 115 μmol/L). We do not believe that the death from lymphoma of one of the renal recipients is related to ecstasy, but was probably related to the immunosuppression. The other three recipients did not present any complication during the follow-up of 4.5 years and 7 months, respectively, and maintained a strictly normal renal function. The renopancreatic transplantation was successful. During the 7 months of follow-up, the recipient maintained normal glucemia and renal function. The two liver transplantations were successful, although in both recipients the pathologies that led to the transplantation reoccurred in the grafts. No sign of hepatotoxicity due to ecstasy was observed in the two donors during the pretransplantation evaluation of both livers: hepatic function tests, hepatic ultrasound, and macroscopic evaluation. The posttransplantation liver biopsy specimens did not reveal signs of toxicity caused by ecstasy in either of the two recipients.

In conclusion, the transplantation of organs from donors who die of MDMA intoxication do not transfer the toxicity to the recipients, and all the thoracic and abdominal organs of these brain-dead donors can be viable for transplantation.

MDMA is a potentially hepatotoxic drug (*11, 31–33*). The etiology of this hepatic toxicity is probably multifactorial, and immunologic mechanisms and hyperthermia have been involved (*9, 31, 32*). According to some authors, the intensity of the hepatic damage does not seem to be related either to the quantity or to the frequency of ingestion of ecstasy, and they suggest a reaction of an idiosyncratic type (*11, 32*). The clinical pattern ranges from asymptomatic alteration of the hepatic function tests to acute hepatic failure (*11, 31–34*). Acute hepatitis is the most frequent form of clinical presentation (*11, 33*), the interval between the ingestion of ecstasy and the symptomatology can vary between 1 and 28 days (*11, 32, 33*), and spontaneous recovery normally occurs between 3 weeks and 3 months (*11, 33*). Cases of subacute toxicity, hepatic fibrosis, and relapsing hepatitis have also been described after repeated ingestion of this substance (*11, 31*). No case of cirrhosis or hepatocarcinoma has been described as a result of consumption of MDMA. At a histologic level, numerous hepatic structural lesions have been described, from microvesicular steatosis to massive hepatocellular necrosis (*11, 13, 31–33*).

Ecstasy-induced fulminant hepatic failure may progress to multiorgan failure, with a mortality of over 50% (*11, 32*). These patients may require treatment involving liver transplantation (*11, 23, 32, 34–40*), as occurred in our three patients. Fifteen cases of liver transplantation, nine conventional and six auxiliary, have been published in the literature in patients with fulminant hepatic failure after MDMA ingestion (*11, 23, 32, 34–40*). The posttransplantation survival rate in this series was 60% (9 of 15). Liver transplantation was successful in seven cases. In a further two with auxiliary liver transplantation, the recovery was partial and the patients still needed the auxiliary graft function at 5 and 18 months after transplantation, respectively (*35*). The posttransplantation mortality rate was 40% (6 of 15), and the main causes of death were sepsis in 4 cases, acute rejection in 1 case, and unknown in 1 case. In the face of the presentation of grade I to II hepatic encephalopathy in a patient with acute hepatocellular failure after consumption of ecstasy, urgent liver transplantation should be considered, as occurred in our three patients, because grade III to IV encephalopathy is normally associated with bad prognosis, even after liver transplantation (*23, 32, 38*).

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