S. SEROTONINERGICO

M. PALOMAR
SMI H VALL HEBRON. BCN
In March 1984 18-year-old Libby Zion was admitted to Cornell Medical Center’s New York Hospital emergency room with a high fever, chills, and dehydration.

Zion came to the ER and was seen by a junior resident who discussed the case by telephone with the referring physician. Zion was believed to have a common viral syndrome, was admitted to the medical service at 2 AM and was given Tylenol.
The junior resident and intern re-examined Zion together later and prescribed **meperidine**, a strong analgesic, for chills and "agitation," in spite of the fact that the physicians knew Zion took **phenelzine**, a common antidepressant at the time.

Phenelzine is a **MAO inhibitors**. All MAO inhibitors are and were commonly known to **be potentially fatal** when taken **in combination with drugs like meperidine**.

After receiving the meperidine, Zion was noted to be restless and confused. The intern, responsible for numerous other patients and having already worked more than 18 hours without a break, ordered **restraints and haloperidol**.

By 6 AM Zion had an axillary temperature of **42° C.** Shortly thereafter she went into **respiratory arrest and died**.
Libby Zion's father, an attorney and writer for The New York Times, persuaded New York District Attorney Robert Morgenthau to begin a grand jury investigation into his daughter's death.

In the end there were no criminal indictments of the involved doctors; however, the grand jury investigation did result in a successful indictment of the system.

Five general problems, most prominent among them sleep deprivation and inadequate resident supervision, were noted.
Five specific factors were identified as contributing to her death:

1 she was not examined by an attending physician with experience in emergency medicine when admitted to the ER in an agitated condition, complaining of fever;

2 after transfer to a medical unit, she was cared for by first- and second-year residents who were largely unsupervised;

3 she was admitted at 2:00 a.m., when both residents caring for her had been at work for 18 straight hours;

4 the first-year resident ordered that she be placed in physical restraints without reevaluating her condition; and

5 she was given meperidine (Demerol) despite the resident’s knowledge that she was also taking phenalzine.
In 1989, New York state adopted the Bell Commission's recommendations (Ad Hoc Advisory Committee on Emergency Services):

- residents could not work more than 80 hours a week or more than 24 consecutive hours and

- attending physicians needed to be physically present in the hospital at all times
S. SEROTONINERGICO

Reacción adversa grave, caracterizada por
- cambios estado mental
- hiperactividad autonómica
- anormalidades neuromusculares

Causado por:
- uso terapéutico
- intoxicación voluntaria
- interacción entre drogas.

No es una reacción idiopática. Es la consecuencia (predecible) del exceso de serotonina en los receptores serotoninérgicos postsinápticos del SNC y periféricos.
La serotonina (5-hidroxitriptamina, 5-HT) es un neurotransmisor derivado del triptófano de la dieta. Descubierto en 1948, se reconoce que tiene un papel importante en múltiples procesos.

Tiene efectos a nivel:

- **central**, regulando el humor, la percepción del dolor, el sueño, el apetito y el vómito.
- **periférico**, participando en la función neuromuscular, la motilidad digestiva y la agregación plaquetaria.
Decarboxilación/hidroxilación L-triptófano
↓
Serotonina

Actividad y cantidad regulada por:
- mecanismos de recaptación
- procesos de feedback
- enzimas metabolizadores

Receptores serotoninérgicos:
7 familias 5HT$_1$- 5HT$_7$.
Algunos múltiples miembros 5HT$_{1A}$- 5HT$_{1F}$

El S. serotoninérgico parece depender fundamentalmente de 5HT$_{2A}$

Otros receptores (5HT$_{1A}$) pueden controlar la interacción que aumenta la concentración de 5-HT sináptica
INCIDENCIA
S. SEROTONINÉRGICO

- Oaten y Sjordan Neurology 1960: 10:1076
  1ª descripción síntomas en pacientes en tº con IMAO que recibían triptófano

  Revisión de 38 casos: 10 comunicaciones de casos y 2 series → Criterios diagnósticos del Síndrome serotoninérgico
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INCIDENCIA

- Incremento paralelo al uso de agentes pro-serotoninérgicos

- Afecta a todas las edades, desde niños a ancianos.

- 2002 Toxic Exposure Surveillance System (información de S de UCIAs, pts ingresados y consultas):
  26.733 incidencias por exposición a IRS
  7.349 pacientes con clínica significativa
  14-16% de las intoxicaciones por IRS presentaban S serotoninérgico
  93 muertes
S. SEROTONINERGICO
INCIDENCIA

Estudio multicéntrico años 1994-5 en los S de Urgencias de H de Cataluña, IRS ocupaban el 5º lugar entre las int por fármacos.

SEMESTOX Estudio año 2000 en 14 S de Urgencias de H españoles, IRS 2º lugar entre las intoxicaciones por fármacos.

* Inhibidores recap. Serotonina
** Analgésicos no opiáceos (incluye Aines)
*** Paracetamol
**** Neurolépticos

S. Serotoninérgico
Causas e interacciones
S. SEROTONINERGICO
FARMACOS Y COMBINACIONES ASOCIADAS

IMAOs
ADT
IRS
Opiáceos
ATB
Antieméticos
Antimigrañosos
Drogas de abuso
Productos herbales
The Serotonin Syndrome
Harvey Sternbach, M.D.

<table>
<thead>
<tr>
<th>Drug Combinationa</th>
<th>Number of Patients</th>
<th>Reference Numbers for Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-Trp and an MAOI (with lithium)</td>
<td>16</td>
<td>17, 19, 20–23, 27</td>
</tr>
<tr>
<td>Fluoxetine and an MAOI</td>
<td>14</td>
<td>26–28</td>
</tr>
<tr>
<td>Fluoxetine and L-Trp</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Clomipramine and clorgyline</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Bromocriptine and L-dopa/carbidopa</td>
<td>1</td>
<td>25</td>
</tr>
</tbody>
</table>

aL-Trp = L-tryptophan; MAOI = monoamine oxidase inhibitor.
### Table 1. Drugs and Drug Interactions Associated with the Serotonin Syndrome.

#### Drugs associated with the serotonin syndrome

- Selective serotonin-reuptake inhibitors: sertraline, fluoxetine, fluvoxamine, paroxetine, and citalopram
- Antidepressant drugs: trazodone, nefazodone, buspirone, clomipramine, and venlafaxine
- Monoamine oxidase inhibitors: phenelzine, moclobemide, clorgiline, and isocarboxazid
- Anticonvulsants: valproate
- Analgesics: meperidine, fentanyl, tramadol, and pentazocine
- Antiemetic agents: ondansetron, granisetron, and metoclopramide
- Antimigraine drugs: sumatriptan
- Bariatric medications: sibutramine
- Antibiotics: linezolid (a monoamine oxidase inhibitor) and ritonavir (through inhibition of cytochrome P-450 enzyme isofrom 3A4)
- Over-the-counter cough and cold remedies: dextromethorphan
- Drugs of abuse: methylenedioxymethamphetamine (MDMA, or “ecstasy”), lysergic acid diethylamide (LSD), 5-methoxydiisopropyltryptamine (“foxy methoxy”), Syrian rue (contains harmine and harmaline, both monoamine oxidase inhibitors)
- Dietary supplements and herbal products: tryptophan, *Hypericum perforatum* (St. John’s wort), Panax ginseng (ginseng)
- Other: lithium
Drug interactions associated with severe serotonin syndrome
Zoloft, Prozac, Sarafem, Luvox, Paxil, Celexa, Desyrel, Serzone, Buspar, Anafranil, Effexor, Nardil, Manerix, Marplan, Depakote, Demerol, Duragesic, Sublimaze, Ultram, Talwin, Zofran, Kytril, Reglan, Imitrex, Meridia, Redux, Pondimin, Zyvox, Norvir, Parnate, Tofranil, Remeron
Phenelzine and meperidine
Tranylcypromine and imipramine
Phenelzine and selective serotonin-reuptake inhibitors
Paroxetine and buspirone
Linezolide and citalopram
Moclobemide and selective serotonin-reuptake inhibitors
Tramadol, venlafaxine, and mirtazapine
S. SEROTONINÉRGICO

Pueden producir SS:

- Abstinencia/Retirada de medicación
- Dosis única de IRS
- Asociación al tº con IRS de fármacos que inhiben citocromos CYP2D6 y C4P3AY
- Agentes serotoninérgicos tras suspender tº con fluoxetina (5 semanas por la vida media del metabolito norfluoxetina)
- IMAOs irreversibles/no selectivos/IMAOs subtipo A, especialmente combinados con meperidina, dextrometorfano, IRS o MDMA
- Clínica inicio rápido <12 h
Puede empezar minutos después del cambio de medicación o toma autolítica.
60% de los pacientes en las 6 primeras horas.

- Casos moderados pueden tener síntomas sub-agudos o crónicos

- Casos graves: rápida progresión hasta la muerte
3 Clinical features of serotonin toxicity

Neuromuscular effects
- Hyperreflexia
- Clonus
- Myoclonus
- Shivering
- Tremor
- Hypertonia/rigidity

Autonomic effects
- Hyperthermia: mild, < 38.5°C; severe ≥ 38.5°C
- Tachycardia
- Diaphoresis
- Flushing
- Mydriasis

Mental state changes
- Agitation
- Hypomania
- Anxiety
- Confusion
Findings in a Patient with Moderately Severe Serotonin Syndrome

- Mydriasis
- Agitation
- Diaphoresis
- Hyperreflexia (greater in lower extremities)
- Tremor (greater in lower extremities)
- Clonus (greater in lower extremities)
- Increased bowel sounds; may have diarrhea
- Autonomic instability; often hypertensive
- Tachycardia

Spectrum of Clinical Findings
### TABLE 2. The Most Common Clinical Features of the Serotonin Syndrome in 38 Patients in 12 Reports

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental status changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confusion</td>
<td>16</td>
<td>42</td>
</tr>
<tr>
<td>Hypomania</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Restlessness</td>
<td>17</td>
<td>45</td>
</tr>
<tr>
<td>Myoclonus</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>Hyperreflexia</td>
<td>11</td>
<td>29</td>
</tr>
<tr>
<td>Diaphoresis</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Shivering</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Tremor</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Incoordination</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>
Sternbach’s criteria.

1. Recent addition or increase in a known serotonergic agent
2. Absence of other possible aetiologies (infection, substance abuse, withdrawal, etc.)
3. No recent addition or increase of a neuroleptic agent
4. At least three of the following symptoms:
   - Mental status changes (confusion, hypomania)
   - Agitation
   - Myoclonus
   - Hyperreflexia
   - Diaphoresis
   - Shivering
   - Tremor
   - Diarrhoea
   - Incoordination
   - Fever
The Hunter Serotonin Toxicity Criteria: simple and accurate diagnostic decision rules for serotonin toxicity

E.J.C. DUNKLEY¹, G.K. ISBISTER², D. SIBBRITT³, A.H. DAWSON³ and I.M. WHYTE³

Q J Med 2003; 96:635–642
Algorithm for Diagnosis

Sens 84%, Esp 97%
We describe here the occurrence of a serotonin syndrome (SS) in a 64-year-old depressed female patient with alcoholic hepatic cirrhosis after treatment with SSRIs. Two weeks after the increase of the dosage of sertraline, the patient developed a full-blown SS, which resolved completely after the discontinuation of the drug. The therapy with citalopram led again to development of milder SS, this time immediately after the increase of the dosage.

Our case illustrates the variability of the clinical presentation and the temporal evolution of SS in a patient with preexisting medical illness affecting hepatic metabolism.

Reexposure of patients with a history of SS to another serotoninergic drug should be avoided; if necessary, it must be carried out with the most caution.
A 72-year-old white woman was treated with sertraline for depression for 18 months and was then admitted to the hospital with a fractured tibia.

She was administered metoclopramide because of nausea and, within 2 hours, developed agitation, dysarthria, diaphoresis, and a movement disorder.

These symptoms recurred following 2 subsequent administrations of metoclopramide.

Treatment with diazepam led to resolution of symptoms within 6 hours, and there was no recurrence at 6 weeks' follow-up.
A 32-year-old white woman with major depression was treated with 
**venlafaxine** for 3 years.

She was admitted following a fall and, after being given **metoclopramide**, developed movement disorder and a period of unresponsiveness.

After a **second dose of metoclopramide**, these symptoms recurred and were associated with confusion, agitation, fever, diaphoresis, tachypnea, tachycardia, and hypertension.

She improved with administration of **diazepam**, but needed repetition of this treatment over the next 16 hours. Symptoms resolved within 2 days, and she continued venlafaxine with no further adverse effects.
Serotonin syndrome following cardiac surgery

A 49-year-old lady presented with rheumatic mitral disease, cardiac failure and pulmonary hypertension. Comorbidities included hypertension, anxiety and depression. Pre-operative medication included clonazepam 0.5 mg daily, seroquel 25 mg twice daily, and paroxetine 40 mg daily for anxiety and depression.

She underwent mitral valve replacement using a 29 caromedics mechanical valve. Premedication included diazepam 10 mg sixty minutes preoperatively. Anesthetic medication included fentanyl (5 μg/kg), midazolam (0.3 μg/kg), and propofol (9 mg/kg) for induction, rocuronium (1 mg/kg) for muscle relaxation, and sevoflurane (0.5–1.0%) for maintenance during bypass. A target mean arterial pressure > 50 mmHg on CPB was initially managed with intermittent boluses of phentylephrine and vasopressin. Resistant hypotension was managed with a norepinephrine (0.03 μg/kg/min) infusion and methylene Blue (1 mg/kg × 2 doses). Fentanyl was given by intermittent bolus to a total dose of 13 μg/kg. Propofol (25 μg/kg/min) was commenced upon rewarming and continued into the intensive care unit.

Postoperatively, she woke up confused and agitated. Her temperature was 40 °C. Neurologic examination revealed myoclonic jerks, fine tremors of the extremities, dilated pupils, shivering, hyperactive reflexes, and hypertonicity. Muscle rigidity was greater in the lower than upper limbs. The neck was supple. Vital signs included a heart rate of 110/min, blood pressure of 170/100 mmHg, and a central venous pressure of 15 mmHg.

Laboratory tests revealed a peak white cell count of 23.2 × 10^9/l, a peak creatinine of 225 μmol/l, and a peak potassium of 7.1 mmol/l. LDH peaked at 5494 U/l, CPK at 6734 U/l, ALT at 3594 U/l, amylase at 514 U/l, troponin at 2.13 μg/l, and urine myoglobin at 5640 U/l. Blood cultures were negative. Brain CT-scan and MRI revealed no acute pathology. EEG demonstrated disturbances of electrocerebral function, consistent with a toxic encephalopathy, with no evidence of epilepsy.

Based on her preoperative medication, clinical findings and laboratory results, a diagnosis of serotonin syndrome was made. The patient was sedated with propofol, ventilated and paralysed for 24 h. The fentanyl infusion was discontinued. She was treated with a loading dose of 12 mg of cyproheptadine, followed by 2 mg every second hour, for 48 h. Her neurological manifestations and laboratory parameters gradually improved over the next week, and the core temperature reduced. She was extubated one week later, and was transferred to the ward, where recovery of strength and mobility was slow but complete. A psychiatric evaluation was obtained. Quetiapine (50 mg daily) was commenced instead of paroxetine, which is known to potentiate serotonin toxicity. She was discharged home with no neurological deficit, and arrangements for neurological and psychiatric follow-up.
Probable síndrome serotoninérgico por interacción entre amitriptilina, paroxetina y linezolid

Una mujer de 72 años ingresó de manera programada por una coleciostopancreatitis litiasica en el servicio de cirugía general. Su historial médico incluía un síndrome de ansiedad-depresión con trastorno obsesivo en tratamiento con alprazolam, paroxetina, trazodona y venlafaxina, hipertensión en tratamiento con bisoprolol y captopril, cifoescoliosis postfractura T12 y alergia a penicilina y a glucopéptidos. Cuando ingresó se le retiró la medicación psiquiátrica y fue sometida a coelelitiasis laparoscópica. En el postoperatorio desarrolló sangrado peritoneal con compromiso volémico, shock séptico por Staphylococcus aureus resistente a meticilina secundario a una tromboflebitis de la vena innominada derecha e infección urinaria por Escherichia coli. Ante esta situación, fue trasladada a la UCI. Inició terapia con linezolid (600 mg/12 h) y aztreonam. Concomitantemente fue tratada con alendronato, calcio, bisoprolol, captopril, enoxaparina, alprazolam retard 0,5 mg/24 horas, paroxetina 20 mg/24 horas, venlafaxina 75 mg/24 horas y trazodona 100 mg/24 horas. Tras cuatro días en la UCI sufrió una descompensación de su patología psiquiátrica y fue evaluada por psiquiatría, que prescribió amitriptilina 10 mg/24 horas, manteniendo paroxetina 20 mg/24 horas, alprazolam retard 0,5 mg/24 horas, retirándose el resto de medicación psiquiátrica. Transcurridos ocho días de tratamiento psiquiátrico y linezolid, fue trasladada a cirugía general. Se reevaluó su estado mental, observándose la estabilización de su trastorno, por lo que se decidió mantener el mismo tratamiento. Transcurridos 13 días en planta (21° día de tratamiento con amitriptilina, paroxetina y
Probable síndrome serotoninérgico por interacción entre amitriptilina, paroxetina y linezolid

La paciente presentó un episodio de somnolencia, desorientación, confusión, disartría, debilidad en extremidades, taquicardia (frecuencia cardíaca = 135 pulsaciones/minute), hipertensión (presión arterial sistólica/diastólica = 170/70 mmHg), hiponatremia (133 mg/dL) y fiebre (37,8 °C). Horas después manifestó un estado de agitación con hipertonicidad e incrementos variables de la función cardio-respiratoria. Los hemocultivos realizados resultaron negativos y no se pudo detectar ningún foco infeccioso, descartándose la patología infecciosa aguda. La paciente no evidenció insuficiencia cardíaca, hepática, ni renal. No se determinaron niveles plasmáticos de los fármacos implicados. Este cuadro se evaluó por psiquiatría como un síndrome serotoninérgico por interacción entre amitriptilina, paroxetina y linezolid, descartándose una agudización de su patología psiquiátrica. La reacción adversa fue comunicada a la unidad de farmacología clínica del Instituto Catalán de Farmacología, a través del sistema de la tarjeta amarilla.

Inmediatamente se suspendió el tratamiento con amitriptilina y paroxetina. El linezolid fue suspendido cuatro días más tarde para permitir un “periodo ventana”. Transcurridos siete días, al observarse nuevos aislamientos secuenciales de *Staphylococcus aureus* resistentes a meticilina en hemocultivos, se reinició la terapia con linezolid. Simultáneamente, fue reiniciada la terapia con paroxetina. Ambos fármacos fueron administrados simultáneamente durante 13 días sin evidenciarse reaparición del síndrome serotoninérgico. La paciente presentó buena evolución tras 48 días de estancia hospitalaria y fue dada de alta a un centro de rehabilitación para tratamiento de la cifoescoliosis.
**Objectives**: To study the characteristics of the linezolid-associated serotonin syndrome cases.

**Methods**: Database search for linezolid-associated serotonin syndrome.

**Results**: Twelve cases were found. The mean age of patients was 52.8 years. All patients received linezolid concomitantly with selective serotonin re-uptake inhibitor drugs (SSRID). The onset of syndrome was **9.5 days after linezolid introduction** and was directly correlated to patients' age ($P = 0.024$). The symptoms resolved in **2.9 days**. Citalopram was associated with a delayed resolution ($P = 0.018$). A trend was observed towards longer resolution time the longer the half-life of the interacting drug ($P = 0.096$).

**Conclusions**: Patients are at risk when receiving SSRID concomitant with linezolid. The syndrome onset could be delayed in older patients. The resolution could be delayed when citalopram is involved in the syndrome.
• Linezolid was initially discovered as an antidepressant because of its effect on blocking intracellular metabolism of serotonin, norepinephrine, and other biogenic amines.

• As time passed, it was realized that linezolid possessed antibacterial activity, and linezolid has been developed and marketed as such.

• In medicine we are quick to categorize drugs into specific classes as a mechanism to recall indication and use. By classifying linezolid as an antibacterial, it is common to forget about its antidepressant roots.
Connor H. Serotonin syndrome after single doses of co-amoxiclav during treatment with venlafaxine.  

DeSilva et al. Serotonin syndrome in HIV-infected individuals receiving antiretroviral therapy and fluoxetine  
*AIDS.* 15(10):1281-1285, *July 6, 2001*
S. SEROTONINERGICO DIAGNOSTICO

- No confirmación laboratorio
- Historia clínica: fármacos, sustancias de abuso, suplementos dietéticos.
- Clínica:
- Exploración
DIAGNÓSTICO DIFERENCIAL
### Table 2. Manifestations of Severe Serotonin Syndrome and Related Clinical Conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Medication History</th>
<th>Time Needed for Condition to Develop</th>
<th>Vital Signs</th>
<th>Pupils</th>
<th>Mucosa</th>
<th>Skin</th>
<th>Bowel Sounds</th>
<th>Neuromuscular Tone</th>
<th>Reflexes</th>
<th>Mental Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serotonin syndrome</td>
<td>Proserotonergic drug</td>
<td>&lt;12 hr</td>
<td>Hypertension, tachycardia, tachypnea, hyperthermia (≥41.1°C)</td>
<td>Mydriasis</td>
<td>Sialorrhea</td>
<td>Diaphoresis</td>
<td>Hyperactive</td>
<td>Increased, predominantly in lower extremities</td>
<td>Hyperreflexia, clonus (unless masked by increased muscle tone)</td>
<td>Increased, precoma</td>
</tr>
<tr>
<td>Anticholinergic &quot;toxidrome&quot;</td>
<td>Anticholinergic agent</td>
<td>&lt;12 hr</td>
<td>Hypertension (mild), tachycardia, tachypnea, hyperthermia (typically 38.8°C or less)</td>
<td>Mydriasis</td>
<td>Dry</td>
<td>Erythema, hot and dry to touch</td>
<td>Decreased or absent</td>
<td>Normal</td>
<td>Normal</td>
<td>Agitated delirium</td>
</tr>
<tr>
<td>Neuroleptic malignant syndrome</td>
<td>Dopamine antagonist</td>
<td>1–3 days</td>
<td>Hypertension, tachycardia, tachypnea, hyperthermia (≥41.1°C)</td>
<td>Normal</td>
<td>Sialorrhea</td>
<td>Pallor, diaphoresis</td>
<td>Normal or decreased</td>
<td>“Lead-pipe” rigidity present in all muscle groups</td>
<td>Bradyreflexia</td>
<td>Stupor, alert mutism, coma</td>
</tr>
<tr>
<td>Malignant hyperthermia</td>
<td>Inhalational anesthesia</td>
<td>30 min to 24 hr after administration of inhalational anesthesia or succinylcholine</td>
<td>Hypertension, tachycardia, tachypnea, hyperthermia (can be as high as 45.0°C)</td>
<td>Normal</td>
<td>Normal</td>
<td>Mottled appearance, diaphoresis</td>
<td>Decreased</td>
<td>Rigor mortis-like rigidity</td>
<td>Hyporeflexia</td>
<td>Agitation</td>
</tr>
</tbody>
</table>
TRATAMIENTO
**TRATAMIENTO**

Resolución frecuente en 24h. Persistencia síntomas en fármacos con semivida de eliminación larga.

- Retirada del/los fármaco/s causante/s
- Medidas de soporte
- Benzodiazepinas
- Parálisis neuromuscular si hipertermia
- Evitar medidas de contención física
- Antagonistas 5-HT$_{2A}$
• **Agitación**: BZD, incrementa supervivencia en modelos animales

• **Hipertermia**: BZD casos leves. Si > 41°C, relajantes ms no despolarizantes (succinilcolina -> arritmias). No útiles los antitérmicos

• **Antagonistas 5-HT2A**: Eficacia no bien establecida
  - **Ciproheptadina**: 12-32 mg durante 24 h VO o SNG, bloquea 90% de los receptores. Inicio 12 mg -> 2mg/2h si síntomas. Puede dar sedación
  - **Antipsicóticos atípicos**: Olanzapina 10 mg sl ó Clorpromacina 50-100 mg IM. Puede dar hipotensión ortostática o agravar hipertermia
TO THE EDITOR: The serotonin syndrome can occur in a broad range of clinical settings; however, experience with its management is scarce.\textsuperscript{1} Severe cases require immediate and effective therapy and leave little time for expert consultation. Treatment with cyproheptadine, olanzapine, or chlorpromazine is recommended\textsuperscript{1} but seems imprudent in inexperienced hands. Furthermore, these drugs may not be readily available, causing unnecessary delay in treatment.

Recently, we successfully managed a life-threatening presentation of the serotonin syndrome without these drugs. A 72-year-old man using tranylcypromine (60 mg a day) accidentally ingested venlafaxine (300 mg); severe muscular rigidity, delirium, hyperthermia, and respiratory failure developed rapidly. We used propofol\textsuperscript{2} to induce sedation and rocuronium, a nondepolarizing agent, to induce muscular paralysis, followed by intubation and ventilation.\textsuperscript{3} Within two hours, his temperature returned to 37.0°C. His further recovery was uneventful, and he was discharged 48 hours later. This widely practiced method of inducing anesthesia can be used safely and quickly in any hospital setting with an intensive care unit and does not require expertise with the serotonin syndrome.

Jurgen A.H.R. Claassen, M.D.
Harry P.M.M. Gelissen, M.D.

Radboud University Medical Center
6500 HB Nijmegen, the Netherlands
j.claassen@ger.umcn.nl

PREVENCIÓN

- Educación médica
- Modificación prácticas prescriptoras
- Uso sistemas computerizados o asistentes personales en prescripción

Evitar regímenes multifármacos
Detectar fármacos con interacciones
Sistemas vigilancia post-marketing