We suggest that the diagnosis of CAS should be considered in all patients, including the one in the case report by Kati et al. (1), who demonstrate abnormal postanesthetic awakening. Additionally, physostigmine should be readily available (10) and administered perioperatively in situations where the possibility of this diagnosis is considered.

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References

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Dr. Kati does not wish to respond.

Mutism as a Complication of Total Intravenous Anesthesia by Propofol
To the Editor:
We read with interest the recent case report by Kati et al. (1). The authors describe a 56-year-old woman who developed somnolence and mutism for 11 days postoperatively, after total intravenous anesthesia with fentanyl, propofol, and vecuronium for a femur fracture fixation. The authors concluded that this neurologic complication may be attributed to an unknown effect of propofol.
We think another possible explanation for the symptoms described in the case may have been a presentation of central anticholinergic syndrome (CAS). The signs and symptoms of CAS are similar to those described with atropine overdose and consist of somnolence, confusion, amnesia, agitation, hallucinations, ataxia, delirium, stupor, or coma in addition to tachycardia, dry mouth, dry skin, visual disturbances, and dysarthria (2). CAS occurs when drugs occupy central cholinergic sites leading to insufficient release of acetylcholine (2). CAS has been linked to many drugs including atropine sulfate, hyosine, promethazine, benzodiazepines, opioids, halothane, and ketamine (3). CAS has also been described after propofol anesthesia (4) and even after nitrous oxide withdrawal (5). In animal studies, it has been shown that fentanyl has strong affinity for muscarinic receptors, whereas morphine and alfentanil do not exhibit any affinity for muscarinic receptors (6).
Since the patient in the presented case received propofol, fentanyl, and atropine during anesthesia, we feel that CAS is a distinct possibility. CAS symptoms may last from hours to days (7).
The diagnosis of CAS is made by exclusion, after ruling out other causes of delayed recovery from anesthesia and by a positive therapeutic response to physostigmine, a centrally active anticholinesterase agent. The incidence of CAS during the postoperative period has been reported to be up to 9.4% after general anesthesia and 3.3% after regional anesthesia with sedation (2). In a prospective study of 962 patients by Link et al. (8), 18 patients developed the syndrome, all of whom responded promptly to physostigmine administration. Katsanoulas et al. (9), reported two cases in which a delay in diagnosis of CAS resulted in unanticipated intensive care admission and acute lung injury.

New Avenues of Epidural Research
To the Editor:
The case report by Kasai et al. (1) and the accompanying editorial by Rose (2) remind us that the potential for serious risk is inherent with every neuraxial procedure performed. Rose (2) has provided us with some commonsense guidelines to help us prevent such complications. We personally concur with his conclusions but wish to bring attention to two new avenues of research.
Techniques are being developed to help make neuraxial procedures safer, particularly in heavily sedated or anesthetized patients. Techniques are being developed to help make neuraxial procedures safer, particularly in heavily sedated or anesthetized patients. Entry into the epidural or intrathecal space can be reliably demonstrated electrically (3,4). Previous studies (5–7) have demonstrated that a motor response evoked by 1 mA or less indicates the catheter is either in the subarachnoid space (SA) or close to a nerve root (subdural, 0.3 mA; SA, 0.4 mA; immediate proximity to a nerve root, 0.5 mA). These observations support the potential application of electrical epidural stimulation or Tsui test (3–8) as an adjunct method to identify the precise location of a needle or catheter in the epidural space.
A modification of the Tsui test can be used to help guide an insulated needle into the caudal or epidural space (9–10). In a porcine model, Tsui et al. (10) have demonstrated that the test can be used to reliably detect entry of an insulated Tuohy needle into the epidural space. By using supramaximal delivered currents and ensuring the subject has not been paralyzed, proximity to any motor neuron (nerve, nerve root, or spinal cord) can be reliably detected. This is done by sequentially reducing the current to a level where the motor response just disappears, while...
advancing the Tuohy needle using a continuous loss-of-resistance (LOR) technique. Entry into the epidural space will be signaled by a LOR and the simultaneous recurrence of the motor response (at an appropriate myotomal level) with a delivered current well above 1 mA. If, at any time, a motor response occurs at a current below 1 mA, proximity to a nerve structure is assured and further advancement of the needle is not advised as it may risk injury. The use of a nerve stimulator to perform peripheral nerve blocks in anesthetized patients has not been demonstrated to enhance safety (11). However, epidural stimulation, unlike peripheral nerve localization, uses a supramaximal current sufficient to stimulate any motor nerve structure within several centimeters. The principle goal when performing a peripheral nerve block is to seek the minimal current sufficient to stimulate a motor nerve (generally <0.5 mA) (11,12). Although there is only a single published laboratory study examining this application, the test has the potential to monitor a motor response in clinical settings where paresthesia cannot be reported. This technique has potential to make neuraxial procedures safer and should not be overlooked.

Investigators in Europe have developed expertise in visualizing the epidural space with ultrasound (13,14). Real-time imaging with ultrasound may further enhance the safety of neuraxial procedures (15).

While we agree with Dr. Rose (2) that further research is necessary to verify the “broadly held belief that epidural analgesia is associated with better postoperative analgesia,” we feel we also need to address more philosophical issues. For example, what is a reasonable risk? Furthermore, as Dr. Rose implies (2), how can we acquire a fully informed consent when we do not fully understand the nature of the risk? Research into the pathogenesis of spinal epidural hematoma formation, evolution, and incidence is desperately needed.

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In Response:

We wish to thank Dr. Lang for his correspondence. We think epidural techniques will be safer if such new methods of epidural approach develop and gain popularity.

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Fat and Bone Marrow Embolism During Percutaneous Vertebraloplasty

To the Editor:

Chen et al. (1) report a case of pulmonary embolism leading to cardiac arrest during percutaneous vertebroplasty. Increased intraosseous pressure during insertion of cement is the causative factor for the passage of fat and bone marrow into the venous circulation and the right heart. Embolic material can be visualized using transesophageal echocardiography (TEE) (2–4).

In a sheep model (2) TEE revealed during vertebroplasty embolic material in the right atrium and the pulmonary artery. Online data registration showed within 2 ± 1 s after injection of bone cement a decrease of heart rate, mean arterial pressure, and an increase of pulmonary vascular tone. This is supported by a study of Jahn et al. (5), who found that a thoracic sympathetic blockade can improve the cardiovascular outcome after pulmonary embolism. The second (late) reaction is caused by occlusion of pulmonary vessels by fat and bone marrow, leading to reduced left ventricular filling and low output.

Vertebroplasty can cause pulmonary embolism of fat and bone marrow and a cardiac reflex response. A bone-venting hole connected to a vacuum suction (3,4) and epidural injection of local anesthetics may reduce the risk of cardiopulmonary complications.

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