case illustrates that a prolonged block with 2-chloroprocaine (hence the high epidural) can occur not only with abnormal but also with low pseudocholinesterase activity. Even though the frequency of abnormal pseudocholinesterases is low,¹ reduced pseudocholinesterase activity has been described in pregnancy^{2,3} and with drugs like magnesium. Caution about the possibility of abnormal reactions is warranted.

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TOF monitoring is required to achieve effective transient neuromuscular blockade in ICU patients

To the Editor:

National recommendations for clinical practice of sedation in the ICU have been published recently in France.¹ These highly support the usefulness of Train of Four (TOF) monitoring during prolonged neuromuscular blockade, as reported previously.^{2–4} We would like to emphasize, in addition, the usefulness of TOF monitoring to titrate bolus doses of neuromuscular blocking drugs (NMBD) in ICU patients when a transient neuromuscular blockade is required.

We undertook a clinical trial in 22 ventilated patients requiring transient neuromuscular blockade for bronchoscopic procedures. A bolus of 0.1 mg·kg⁻¹ *iv* of pancuronium was administered initially and a second bolus of 0.05 mg·kg⁻¹ 15 min later if the TOF response at the orbicularis oculi muscle was not completely abolished, using a standard peripheral nerve stimulator with surface electrodes. The initial dose of pancuronium was found to completely abolish the TOF response in only 36% of patients, whereas 68% of patients had a completely abolished response following administration of the second dose (Table). Therefore, a “standard intubating dose” of pancuro-

nium (as determined in healthy anesthetized patients and expected to achieve complete paralysis) has only limited relevance in critical care patients. Our results strongly suggest that bolus injections of NMBD in ICU patients should be titrated to the specific target required for brief relaxation, and that TOF monitoring should be used systematically, as recommended for long-term infusions of NMBD.

TABLE

	TOF=0/4	TOF=1/4	TOF=2/4	TOF=3/4	TOF=4/4
First bolus	36%	14%	5%	0%	45%
Second bolus	68%	0%	5%	5%	22%

% of patients having 0/4 to 4/4 responses at TOF at orbicularis oculi after pancuronium boluses

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Pulmonary carbon dioxide embolism during laparoscopic cholecystectomy

To the Editor:

We wish to report an unusual¹ pulmonary carbon dioxide (CO₂) embolism which occurred after intra-hepatic CO₂ insufflation following inadvertent puncture of the liver by a Verres needle.

A 77-yr-old man underwent laparoscopic cholecystectomy under general anesthesia. A Verres needle was inserted at the right subcostal area. Shortly after the onset of CO₂ insufflation, end-tidal CO₂ (P_{ET}CO₂)

suddenly decreased from 35 to 12 mmHg. Then, oxygen saturation (SpO_2), blood pressure and heart rate decreased. Electrocardiogram revealed transient complete right bundle branch block. Insufflation was stopped, and ephedrine and 100% oxygen were administered. Blood pressure, heart rate and SpO_2 returned to normal, and $\text{P}_{\text{ET}}\text{CO}_2$ increased to 22 mmHg over five minutes. Arterial blood-gas revealed pH 7.32, PaCO_2 49.3 mmHg, PaO_2 270.5 mmHg. Thirty minutes later, insufflation was restarted. Laparoscopic inspection showed a tear in the liver surface. When the gallbladder was dissected via the laparoscope, $\text{P}_{\text{ET}}\text{CO}_2$ decreased from 38 to 26 mmHg, whereas PaCO_2 was 46.1 mmHg. After the surgery, the patient complained of chest pain and dyspnea. He was fully recovered following one day of mechanical ventilation.

Since decrease in $\text{P}_{\text{ET}}\text{CO}_2$ was noted soon after the initiation of insufflation, and laparoscopic inspection indicated the inadvertent puncture of the liver by the Verres needle, intrahepatic insufflation of CO_2 should be responsible for the cardiovascular collapse. It has been shown that a 37% incidence of CO_2 embolism during gallbladder dissection.² Because $\text{P}_{\text{ET}}\text{CO}_2$ decreased during gallbladder dissection, CO_2 pulmonary embolism may have recurred. Anesthesiologists should be aware of occurrence of pulmonary embolism during peritoneal insufflation and gallbladder dissection.

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