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A New Complication Due to the Lumbar Sympathetic Block?

To the Editor:—The clinical report by Wills *et al.*[1] documenting the development of Horner's syndrome secondary to lumbar sympathetic block is intriguing, but may be explained by an inadvertant subdural injection.

The subdural space is a potential space located between the dura mater and arachnoid.[2] CSF cannot be aspirated from the subdural space, because this space does not communicate with the subarachnoid space.

Although subdural injection occurs more frequently during myelography,[3] it has been documented as a result of an intended epidural injection.[2,4–6] Potential complications of a lumbar sympathetic block include epidural or subarachnoid injection. Therefore, subdural injection is certainly possible. This is more likely to occur if the transverse process is mistakenly identified as the vertebral body.[7] In Wills *et al.*'s case report,[1] a description of the patient's body habitus and depth of the needle at the time of injection might have indicated whether this was likely to have occurred.

Subdural injection of a local anesthetic is associated with delayed onset, extensive spread, sometimes resulting in weak or patchy anesthesia and relatively rapid recovery.[5,6] In contradistinction to a subarachnoid injection, less motor involvement, less hypotension, and a more gradual onset of respiratory depression may be seen.

The widest aspects of the subdural space have been reported to be located dorsally and laterally.[8] The most likely location of a dural puncture during a lumbar sympathetic block is located anterolaterally. The lateral widening may explain the unilateral sensory changes.[5] Also, because the subdural space extends intracranially,[2] it is not surprising that the patient's sensory deficit included cranial nerve distributions.

Thus, the clinical findings, as presented, suggest not a modulating role of somatic pain by the sympathetic nervous system, but rather an inadvertant subdural injection, as the most likely etiology for the occurrence of Horner's syndrome and unilateral left hypoesthesia following a lumbar sympathetic block.

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REFERENCES

1. Wills MH, Korbon GA, Arasi R: Horner's syndrome resulting from a lumbar sympathetic block. ANESTHESIOLOGY 68:613–614, 1988
2. Mehta M, Maher R: Injection into the extra arachnoid subdural space. Anaesthesia 32:760–766, 1977
3. Cohen CA, Kallos T: Failure of spinal anesthesia due to subdural catheter placement. ANESTHESIOLOGY 37:352, 1972
4. Boys JE, Norman PF: Accidental subdural analgesia. Br J Anesth 47:1111–1113, 1975
5. Manchanda VN, Mierad SHN, Shilyansky G, Mehringer M: Unusual clinical course of accidental subdural local anesthetic injection. Anesth Analg 62:1124–1126, 1983
6. Hartrick CT, Pither CE, Pai U, Raj PP, Tomsick T: Subdural migration of an epidural catheter. Anesth Analg 64:175–178, 1985
7. Murphy TM: Treatment of chronic pain, Anesthesia. Edited by Miller RD. New York, Churchill Livingstone, 1986, pp 2093–2094
8. Shapiro R. Myelography, 3rd edition. Chicago, Year Book Medical Publishers, 1975, pp 124–126

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ECG Artifact Produced by Crystalloid Administration through Blood/fluid Warming Sets

To The Editor:—During the past 2 years, we have observed and documented numerous instances of electrical artifacts appearing on the ECG resulting from the infusion of various crystalloids using Pharmaseal® DWC-100 Blood/Fluid Warming Sets, Pharmaseal® Blood/Fluid Warmers model DW-1000D, and Marquette® 7010 RA monitors. This particular warming set includes two drip chambers, one with a spike for the fluid container and one mounted in a holder on the blood warmer.

Pseudoarrhythmias have been reported in relation to infusion pump operation[1,2] and infusion pumps in combination with defective ECG monitors.[3] Artifactual EEG signals, important with respect to the increased level of intraoperative processed EEG monitoring, have also been reported in association with infusion pumps[4] and drip chambers.[5]

In each instance of documented interference, the monitors and blood warmers were evaluated for proper operation and electrical safety. No defects or faults were uncovered. Patient monitors[3] and inadequate electrode impedance,* from improper skin preparation, have been implicated by some authors. The basis for these assertions is that electrostatic or electromagnetically induced artifacts should appear as a common mode signal to the monitor and, therefore, should not be displayed unless there is a source impedance imbalance from the electrodes. Usually a source impedance imbalance is detectable by the 60 Hz interference accompanying the ECG display. However, in our particular case, electrode source impedance imbalance cannot be proved or disproved by 60 Hz interference alone, because the Marquette® 7010 RA monitor has a notch filter that removes 60 Hz signals without relying on common mode rejection. However, electrode source

* ECRI: Infusion pumps: ECG artifacts from infusion controllers. Health Devices 7:111–115, 1978

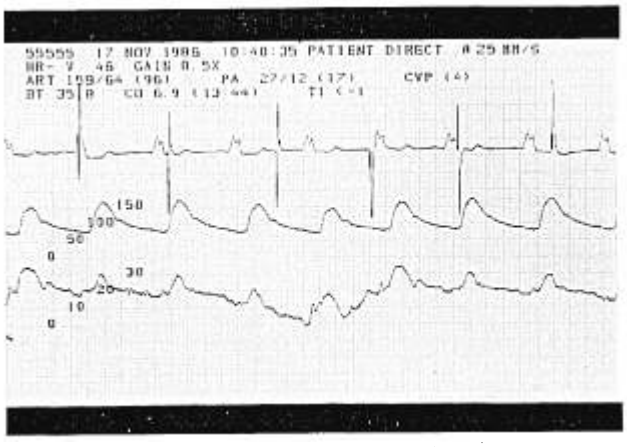

FIG. 1. ECG artifacts with amplitudes of 6.2 mV displayed on lead V_5 with a drip rate of 53 drops/minute.

impedance imbalance is unlikely on the basis that the magnitudes of the artifacts are equal in all leads. Other investigators[5] have shown that electrode impedance alone does not significantly effect the artifact.

The artifact was not altered by unplugging the warmer or rerouting the ECG cables, nor was it consistently eliminated by replacing the administration set.

In one particular situation, as illustrated in figure 1 during the infusion of Lactated Ringers solution, larger artifactual spikes of 6.2 millivolts (mV) appeared on lead V5 coincident with a rate of 53 drops/minute from the drip chamber mounted on the warming unit. Due to the magnitude of these artifacts relative to the patient's R wave amplitude, the heart rate algorithm is counting the drip rate instead of R waves, or sometimes a combination of the two. Figures 2 and 3 illustrate the presence of the artifact in multiple ECG leads, and the inverse relationship between the artifact amplitude (1.1 mV and 0.1 mV, respectively), drop rate (83 drops/minute and 375 drops/minute), and possibly drop size, which is characteristic of the generation of static electricity from water droplets.

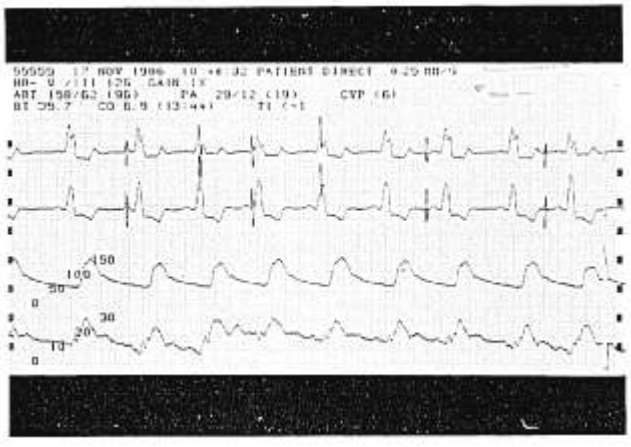

FIG. 2. ECG artifacts with amplitudes of 1.1 mV displayed on leads V_5 and III with a drip rate of 83 drops/minute.

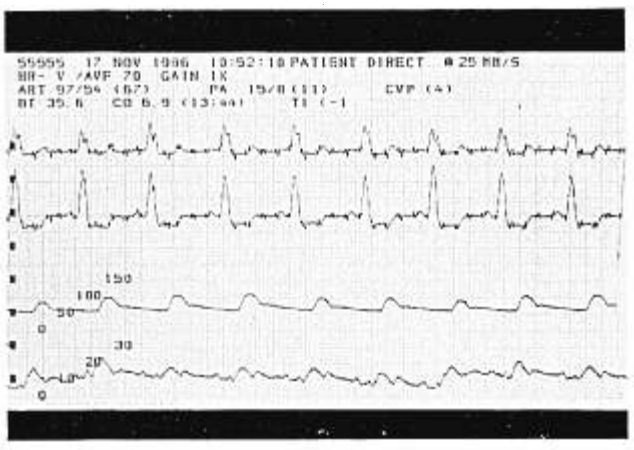

FIG. 3. ECG artifacts with amplitudes of 0.1 mV displayed on leads V_5 and AVF with a drip rate of 375 drops/minute.

In each case, the artifacts could be eliminated by: 1) stopping fluid flow into the drip chamber mounted on the blood warmer; 2) disconnecting the fluid path from the warming set to the patient by turning a stopcock; 3) filling the drip chamber mounted on the blood warmer with enough fluid such that no droplets could be formed, while relying on the drip chamber near the fluid container for flow rate estimation: and 4) providing an electrically conductive pathway across the drip chamber that prevents charge separation and accumulation.

It was observed that replacing the crystalloid solution with blood or blood products also eliminated generation of the artifacts, presumably related to the electrical properties of protein molecules which prohibited charge separation during drop formation.

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REFERENCES

1. Meharg JG: Pseudoarrhythmia secondary to intravenous-infusion device. N Engl J Med 301:165–166, 1979
2. Sahn DJ, Vaucher YE: Electrical current leakage transmitted to an infant via an iv controller: An unusual ECG artifact. J Pediatr 89:301–302, 1976
3. Croke RP, Bulchandani KV, Jacobs WR, Loeb HS: Pseudoarrhythmia due to defective infusion pump and ECG monitor. JAMA 235:705–706, 1976
4. Egol AB, Guntupalli KK: Intravenous infusion device artifact in the EEG-confusion in the Diagnosis of Electrocerebral Silence. Intensive Care Med 9:29–32, 1983
5. Redding FK, Wandel V, Nasser C: Intravenous infusion drop artifacts. Electroenceph Clin Neurophysiol 26:318–320, 1969

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