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Venospasm Preventing Peripheral Venous Access

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Venospasm is a poorly understood phenomenon that occurs primarily at the time of central vein or right heart catheterization. We report a case in which venospasm occurred with insertion of a peripheral intravenous catheter, preventing venous access in an anesthetized patient.

REPORT OF A CASE

An eleven-year-old boy with cerebral palsy, mental retardation, and congenital hydrocephalus with a functioning ventriculoperitoneal shunt was scheduled to have hip and knee releases for spasticity of the lower extremities. The patient previously had numerous general anesthetics at different hospitals, from which no old records were available. The only previous anesthetic problem related by the parents was that the patient required prolonged postoperative endotracheal intubation on one occasion for what apparently was postintubation croup. The patient was receiving no medications and had no known allergies. Physical examination revealed no cardiovascular abnormalities. Laboratory examination was unremarkable.

The patient was premedicated with atropine 0.4 mg po. An inhalation induction of anesthesia was performed with nitrous oxide and gradually increasing halothane concentrations. Following induction, a 20-gauge, 32-mm Teflon® intravenous catheter (Critikon Cathlon IV) was inserted easily into a vein on the dorsum of the left hand. There was good blood return initially through the catheter before and after removal of the obturator, but the intravenous solution, consisting of 5% dextrose in lactated Ringer's solution (D_5LR), would not flow. Flushing of the catheter with a 3-ml syringe was attempted but was not possible using moderate force, even when the catheter was withdrawn almost out of the vein and readvanced several times. Attempted flushing produced only a blanching of the skin around the tip of the catheter accompanied by a localized wheal 2 cm in diameter that resembled an intradermal injection, having the characteristic "orange skin" appearance. Backflow of blood no longer occurred when the syringe was disconnected from the catheter.

A similar 20-gauge intravenous catheter then was inserted into a vein in the dorsum of the right hand, again without difficulty. There was free flow of blood through the catheter, but upon attempted infusion of the intravenous solution with a different bottle of D_5LR there was no flow. Flushing and withdrawing of the catheter was attempted, producing the same results as on the previous occasion. Two per cent lidocaine was injected into each of the catheters in the hands. Injection of 0.2 ml into each catheter was difficult, requiring significant force applied to a 3-ml syringe for 10–15 seconds and causing no change in venospasm. The left external jugular vein then was cannulated with a 20-gauge catheter, through which the same intravenous crystalloid flowed readily. Endotracheal intubation then was performed with the aid of succinylcholine, and the remainder of the operative course was uneventful.

The peripheral catheters were removed at the conclusion of the case after it was apparent that the venospasm would not relax before emergence from anesthesia. Inspection of the catheters showed that they were not crimped. The postoperative course was uneventful. Postoperative inspection of venipuncture sites revealed no evidence of inflammation or other abnormalities.

DISCUSSION

Venospasm occurs with central vein and right heart catheterization via peripheral veins. One study in which 4,413 right heart catheterizations were performed re-

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ported the incidence of venospasm to be 2% and occurred most frequently when the veins were small or tortous.[1] Our case most probably represents peripheral venospasm occurring in both upper extremities and preventing venous infusion following insertion of simple intravenous catheters in an anesthetized patient. Other possible explanations for the difficulties encountered were as follows. 1) The possibility exists that the catheters were not inserted intravenously; however, there was free flow of blood from the catheters, which were felt to thread into the veins quite easily. Also, upon attempted flushing of the catheters, no fluid could be forced into the catheter, and no evidence of subcutaneous infiltration was present. 2) The possibility that a substance in the bottles of intravenous fluid precipitated the episode also is unlikely, because two different bottles of D_5LR caused the same response in two different veins, while one of the same bottles caused no problem when perfused via the external jugular vein. 3) The possibility that it was caused by the tips of the catheters being lodged against venous valves is doubtful because withdrawal of the catheter approximately 2.5 cm from either hand did not allow solution to flow, even when flushed with moderate force applied to a 3-ml syringe. 4) There is the possibility that catheters clotted. This is felt to be highly unlikely because the veins were cannulated easily on the first attempt, and the IV solution connected within only a few seconds. This is too short a period to allow any significant clot formation. 5) The catheters were crimped. No undue resistance was encountered upon insertion of either catheter. They were inspected upon removal at the end of the case and showed no evidence of crimping.

Although venospasm cannot be proven to have occurred, it is the most likely explanation for the unusual events that we have described. That the obstruction to flow occurred distal to the catheter tip can be inferred by the localized wheals surrounding the catheter tips that were produced upon forceful attempted flushing of the catheters. Complete obstruction of the vein just beyond the catheter tip would allow the increased intraluminal pressure to be transmitted in a retrograde fashion to the connecting capillary network, causing interstitial fluid extravisation, resulting in wheal formation and blanching of the skin, as we observed. It is doubtful that any other form of obstruction to the catheter itself could have produced this phenomenon.

Injection of local anesthetic into the intravenous catheter may be efficacious in relieving venospasm, yet this had no effect in our patient. This may be because the high degree of venospasm prevented a significant volume of lidocaine from being injected beyond the catheter tip into contact with the vein wall. Another potentially useful maneuver, as reported by Morgan and Glasser,[2] is the administration of sublingual nitroglycerin for relief of venospasm in patients during right heart catheterization. In an anesthetized patient, parenteral vasodilators such as nitroprusside or intravenous nitroglycerin also might be considered.

Injection of other smooth muscle relaxants, such as slow channel blockers, papaverine, or adenosine triphosphate, also may be postulated to be useful. These drugs were not used in our patient.

Another maneuver that can relieve venospasm preventing passage of central vein catheters via peripheral veins is the gradual attempted insertion and withdrawal of the catheter. Often the vein can be felt to relax suddenly. Usually, the problem encountered is failure to pass or remove the catheter, not difficulty with infusion *through* it, as was encountered in our report.

The pathophysiology of the smooth muscle contraction involved in venospasm has not been described well. There appears to be some contribution to resting venous tone by the sympathetic nervous system,[3] suggesting that sympathetic blockade also may be worth considering for relief of intractable venospasm. The observation that small and tortuous peripheral veins appear to go into spasm more readily than larger ones, perhaps because of increased stimulation of the vessel wall by the catheter, is consistent with the events described in this case report. The larger-diameter, external jugular vein behaved differently, not exhibiting the spasm that occurred in the smaller veins of the hands.

If peripheral venospasm preventing intravenous infusion or catheter passage is unrelieved by the administration of smooth muscle relaxants or in-and-out movement of the catheter, then cannulation of a larger-diameter vein obviously should be attempted. If venospasm remains refractory, then sympathetic blockade may be useful in obtaining relaxation and restoring venous access to the central circulation.

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