The Topical Use of Sodium Nitroprusside for Relief of Intraoperative Arterial Spasm

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Present indications for the use of sodium nitroprusside have been predicated for its iv administration. We present four brief case reports in which sodium nitroprusside safely has been used by topical application to relieve arterial spasm.

REPORT OF FOUR CASES

Patient 1: A 58-year-old woman with a Dupuytren's contracture of the right hand was scheduled for surgical release of the contracture. A brachial plexus block using 0.5% bupivacaine was performed, and iv sedation with diazepam and morphine sulfate was given. A pneumatic vascular tourniquet was placed and inflated to provide a bloodless surgical field. During the procedure, arterial spasm was observed in the affected digit. A solution containing 50 mg sodium nitroprusside in 250 ml D₂W was prepared, and, via sterile iv tubing, a small quantity (less than 5 ml) of this solution was dripped onto the affected artery, with immediate relief of the spasm. The patient's blood pressure was monitored every 30–60 s during administration, and there were no changes in blood pressure or heart rate during the application of sodium nitroprusside.

Patient 2: A 25-year-old woman was scheduled for a pedicle graft to her right thumb. General anesthesia was induced with thiopental and was maintained with enflurane, nitrous oxide, and oxygen. A pneumatic vascular tourniquet was placed on the right arm and remained inflated for 114 min while a vascular reanastomosis was performed. After release of the tourniquet, blood supply to the graft was poor, as evidenced by the cyanotic appearance of the graft. Examination revealed the reanastomosed artery to be in spasm. First, 2 ml topical 1% lidocaine and then 60 mg topical papaverine were applied to the artery without resolution of this vasospasm, and then 2–3 ml sodium nitroprusside (0.2 mg/ml) was then applied via sterile iv tubing with rapid relief of the spasm and cyanosis. Arterial blood pressure was measured every 30–60 s during the administration of nitroprusside, and blood pressure and heart rate did not change.

Patient 3: A 32-year-old man had traumatic amputation of both feet and was transported to our hospital. When his injury was approximately 6 h old, the decision was made to attempt reimplantation. Anesthesia was induced with thiopental and succinylcholine and maintained with halothane, nitrous oxide, and oxygen. After induction a radial artery catheter was inserted and used for continuous blood pressure monitoring. During the course of surgery, the reanastomosis of severed vessels was facilitated by the use of topically applied sodium nitroprusside (0.2 mg/ml) drawn up in syringes. The total dose of nitroprusside used for both feet was less than 10 mg. Arterial blood pressure and heart rate did not change during the period in which nitroprusside was administered, even though vascular tourniquets were not used.

Patient 4: This 25-year-old man underwent left donor nephrectomy for a kidney transplant from a living relative. Anesthesia was induced with thiopental and maintained with isoflurane, nitrous oxide, and oxygen. After exposure and preparation for removal, the kidney became cyanotic and the renal artery was observed to be in spasm. Sodium nitroprusside (0.2 mg/ml) was drawn up in a 5-ml syringe and then applied to the renal artery, and the color of the kidney immediately improved. Less than 2 ml of the nitroprusside solution was used. Arterial blood pressure and heart rate measured every 30–60 s remained constant during sodium nitroprusside application.

DISCUSSION

There have been few instances of non-iv use of sodium nitroprusside reported. Husted et al.¹ reported a case in which arterial spasm resulting from ergotamine toxicity was treated with the use of intraarterial sodium nitroprusside. Guinto et al.² reported that topically administered sodium nitroprusside (50 mg in 100 ml D₂W) would relieve spasm in the segmental arteries and thus relieve ischemia without causing hypotension in experimentally strangulated bowel in dogs. Nolph et al.³ reported that the addition of nitroprusside (up to 9 mg total dose) to peritoneal dialysis fluids increased clearance without significant hypotension or tachycardia.

The question of systemic effects of sodium nitroprusside is an important one, and our results, combined with the reports of both Guinto et al.² and Nolph et al.³ indicate that hypotension is not a significant problem when small amounts of sodium nitroprusside are used topically. Even in our patient 3, where 40–45 ml of sodium nitroprusside solution (0.2 mg/ml) was used over the course of several hours, we observed no hypotension. Hill⁴ in 1942 reported that sodium nitroprusside decomposed on contact with tissue to cyanogen, a reaction that also takes place in the blood.⁵–⁷ This breakdown could account for the lack of systemic effects. Guinto et al.² further suggest that, when used in the peritoneal cavity, sodium nitroprusside is inactivated during the first pass through the liver, and he administered an intraperitoneal dose of 500 mg/kg sodium nitroprusside to dogs to achieve the same degree of hypotension as produced by the iv use of 20 mg/kg sodium nitroprusside.

Other than excessive vasodilation evidenced by hypotension and tachycardia, the most important adverse effect of sodium nitroprusside is cyanide toxicity, which is dose dependent. The maximum safe dose may be 1

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mg/kg in a 4-h period. An advantage of topical application is that a relatively small dose may be applied to a limited area, and in our cases the total dosage was always less than 0.1 mg/kg.

In addition to its use in revascularization, topical sodium nitroprusside could also be of value in other vascular procedures such as shunts for dialysis, neurosurgical operations involving microvascular surgery, kidney transplantation, and any instance of spasm caused by surgical manipulation.

In summary, sodium nitroprusside has been applied topically to arteries in spasm in the four cases presented. In all of these cases the spasm was relieved and no systemic effects of sodium nitroprusside were observed. We believe that the topical use of sodium nitroprusside for relief of arterial spasm is a safe and effective technique that facilitates operation, is devoid of measurable systemic effect, and requires only the usual standard of care with close observation of vital signs and communication between surgeon and anesthesiologist.

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Transesophageal Pacing for Bradycardia

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Sinus bradycardia during anesthesia is often acute in onset, may produce hypotension, and may lead to more serious dysrhythmias. The response of bradycardia to pharmacologic intervention is unpredictable, and therefore cardiac pacing provides a more precise and effective treatment.

Current preoperative consideration of transvenous cardiac pacing in patients undergoing surgery has focused on conduction defects such as complete heart block. The development of esophageal electrodes for overdrive cardiac pacing as treatment for tachycardias suggested to us the use of transesophageal pacing for correction of unexpected sinus bradycardia in patients undergoing anesthesia. Transesophageal pacing for sinus bradycardia or asystole offers the potential for a quickly established treatment that achieves a predetermined heart rate without need for time-consuming and difficult intravascular procedures. We report here our experience with 37 surgical patients successfully treated by transesophageal pacing for hemodynamically significant bradycardias.

METHODS

The study was conducted in accordance with guidelines of the institutional Joint Committee on Clinical Investigation. The need for traditional intracardiac pacing was not anticipated preoperatively, and none of the 37 patients had preoperative electrocardiographic evidence of atrioventricular conduction disturbance. The mean age ± SD of the patients was 62 ± 7 years. Thirty-six of the patients underwent coronary artery bypass surgery; 33 patients had triple-vessel coronary artery disease; and 13 patients had a left main coronary artery stenosis of 50% or greater. The one patient not studied with coronary angiography had stable angina and underwent carotid endarterectomy. Thirty-one patients received propranolol chronically, which was continued to the time of surgery. All patients had preoperative

REFERENCES


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