

# Transcatheter vasopressin infusion therapy in the management of acute gastrointestinal bleeding

Paul C. Janicki, M.D.  
Ralph J. Alfidi, M.D.

*Department of Diagnostic Radiology*

Avram M. Cooperman, M.D.

*Department of General Surgery*

Development of modern angiographic techniques and the infusion of vasopressin (Pitresin) into selected mesenteric arteries have aided the radiologist in the identification of acute gastrointestinal hemorrhage and subsequent treatment of the patient. The efficacy of selective infusion of vasopressin for control of acute arterial and variceal bleeding is substantiated in recent publications. This study summarizes the experience of the Cleveland Clinic from 1971 to 1974.

## Results

This is a retrospective study of 201 patients who underwent arteriography from January 1, 1971, to October 31, 1974, because of a history of either acute or chronic gastrointestinal bleeding. Patients were considered to have acute bleeding if the blood was bright red by nasogastric tube or by rectum, if falling hematocrit necessitated transfusion, or if there was some other evidence of an acute bleed at the time of hospital admission prior to angiography. There were 118 acutely bleeding patients, and 82 were considered to have a chronic bleed. One study was considered technically unsatisfactory. The site of hemorrhage was correctly identified in 61

of the 118 with acute bleeding (52%). In 38 of the 57 patients in whom the site of hemorrhage was not identified, angiography was done at least 48 hours after admission, or there was some clinical indication that hemorrhage had stopped by the time of the angiogram.

Forty-three patients had active arterial bleeding demonstrated by angiography, and 18 patients had evidence of portal hypertension and variceal bleeding. Twenty-three of the 43 with arterial bleeding were given infusions of vasopressin; only seven of those with variceal bleeding received infusions. Eleven patients had negative angiograms but were given infusions as a prophylactic measure. Therefore, a total of 41 patients received infusions of vasopressin over a 3-year period.

For the purpose of this study, the patients who had infusions were classified as follows: Group 1: Bleeding was completely controlled without operation; the patients had no further bleeding and were discharged; Group 2: Bleeding was controlled, but patients re-bled or later required an operation; Group 3: Bleeding was not controlled; patients usually required an operation.

Of the 23 patients with arterial bleeding, 11 were in Group 1, 3 in Group 2, and 9 in Group 3 (Table 1). Thus, 14 of the 23 patients were successfully controlled with vasopressin at least temporarily. Of the 11 patients who received infusions as a prophylaxis, five were in either Group 1 or 2, and six were in Group 3 (Table 2). Of the seven patients with variceal bleeding, four patients were in Group 1 and three in Group 3 (Table 3).

Twenty patients in whom active arterial bleeding was identified did not

**Table 1.** Extravasation/vasopressin; 23 patients

| Group                                 | No. of patients |
|---------------------------------------|-----------------|
| <b>Group 1</b>                        |                 |
| Left gastric artery                   | 6               |
| Gastroduodenal artery                 | 3               |
| Superior mesenteric artery            |                 |
| Pancreatic arcade                     | 1               |
| Arteriovenous malformation            | 1               |
|                                       | —               |
| Total                                 | 11              |
| <b>Group 2</b>                        |                 |
| Left gastric artery                   | 1               |
| Gastroduodenal artery                 | 1               |
| Celiac artery (left gastric stenotic) | 1               |
|                                       | —               |
| Total                                 | 3               |
| <b>Group 3</b>                        |                 |
| Superior mesenteric artery            | 4               |
| Celiac artery                         | 3               |
| Splenic artery                        | 1               |
| Inferior mesenteric artery            | 1               |
|                                       | —               |
| Total                                 | 9               |

**Table 2.** Negative angiogram—infusion (prophylactic)

| Group | No. of patients |
|-------|-----------------|
| 1     | 1               |
| 2     | 4               |
| 3     | 6               |
|       | —               |
| Total | 11              |

All patients bleeding acutely.

receive infusions, either because of massive bleeding necessitating immediate surgery or inability to perform selective catheterization.

Thirty-six patients had positive angiograms because of angiopathy, although there was no evidence of an active bleed. Twenty-three of these patients had chronic gastrointestinal bleeding; the majority of these patients had some type of arteriovenous malformation, although there was a spectrum of diagnoses (Table 4).

**Table 3.** Variceal bleeding; infusions

| Group | No. of patients |
|-------|-----------------|
| 1     | 4               |
| 2     | 0               |
| 3     | 3               |
|       | —               |
| Total | 7               |

**Table 4.** Final diagnoses (proved at operation)

| Diagnosis   | No. of patients |
|---|-----------------|
| 1. Hemangioma/arteriovenous malformation/telangiectasia | 9               |
| 2. Small bowel tumors                                   | 3               |
| 3. Pancreatic carcinoma                                 | 2               |
| 4. Aneurysms; visceral artery                           | 2               |
| 5. Unknown etiology                                     | 2               |
| 6. One of each  |                 |
| Polyp   | 1               |
| Pseudocyst  | 1               |
| Hepatoma  | 1               |
| Colonic carcinoma                                       | 1               |
| Gangrenous colon  | 1               |
| Hemangioma (liver)                                      | 1               |
| Islet cell tumor  | 1               |
|   | —               |
| Total   | 25              |
| No operation/x-ray diagnoses                            |                 |
| 1. Hemangioma/arteriovenous malformation/telangiectasia | 6               |
| 2. Unknown etiology                                     | 5               |
|   | —               |
| Total   | 11              |

## Discussion

Many investigators have substantiated the use of angiography for localization of an acute bleed.<sup>1-5</sup> Nusbaum and Baum,<sup>3</sup> in 1963, showed experimentally in dogs that as little arterial bleeding as 0.5 ml/min could be visualized by angiography. Clinically, the rate of bleeding required for identification is somewhat greater, probably ranging from 1.0 to 3.0 ml/min. In six large series of acutely bleeding patients, the success rate of localization of arterial hemorrhage was 65%.<sup>1, 2, 5-7</sup> This compares with our

success rate of 52%. A significant number of our patients, however, had angiography rather late in their hospitalization, some after a barium study of the gastrointestinal tract. This approach precludes identification of the bleeding site, since arterial bleeding is generally thought to be episodic. Arteriography, like gastroscopy, should be considered an emergency diagnostic procedure and should be done as soon as possible when the patient is bleeding clinically. The use of barium is contraindicated since it makes angiography impossible for at least 24 hours.

Vasopressin has been used for control of arterial bleeding since 1967, when Nusbaum et al<sup>8, 9</sup> introduced selective pharmacangiography for control of bleeding varices. They showed that portal pressure and associated variceal bleeding could be controlled by selective infusion into the superior mesenteric artery. Subsequently, in another group of patients, they were able to control arterial bleeding as well.<sup>4, 10</sup> Since then, vasopressin has been used for control of hemorrhage from Mallory-Weiss tears, gastritis, superficial and stress ulcers, as well as for control of lower intestinal bleeding, particularly from diverticula and arteriovenous malformations. Bleeding peptic ulcers, however, are more difficult to control, possibly because arterioles and capillaries are the vessels most constricted. The gastroduodenal artery is a large, high-flow artery. Moreover, the dual blood supply to the duodenum and gastric antrum may compensate for constriction of either the celiac or superior mesenteric artery, allowing continuous blood flow despite infusion.

Subselective catheterization of the bleeding vessel is important. Of the

23 patients who were given infusions, 14 were successfully controlled and nine were not. The controlled patients had more subselective catheterizations and infusions than those not controlled (*Table 1*). For instance, of the patients with hemorrhaging peptic ulcers, four were controlled and three were not. The gastroduodenal artery was selectively catheterized in the controlled patients and either the celiac or superior mesenteric artery in those was not controlled. These results, together with our more recent experiences, suggest the importance of selective catheterization. There is, however, no way to predict and, in several instances, large duodenal bleeds have been controlled by simple infusion into the celiac axis.

Prophylactic infusion of vasopressin without definitive localization of the bleeding site is not efficacious. Eleven patients were given infusions because of clinical indications. There were six failures, and only one patient was satisfactorily controlled. These results indicate that, unless a bleeding site is found, the catheter should be removed and the procedure discontinued. The patient may be studied later if bleeding continues. Recently, several patients with negative angiograms were actively bleeding clinically. Repeat studies within minutes of the initial studies showed the bleeding site. As previously noted, arterial bleeding is thought to be episodic; and contrast material, a potent vasodilator, may have reactivated the bleeding site.

Intravenous administration of high doses of vasopressin was first used for the management of massive esophageal variceal hemorrhage in 1956.<sup>11</sup> In 1967, Nusbaum et al<sup>9</sup> showed that selective arterial infusion of 0.1 to 0.4 units per minute would

decrease splanchnic blood flow and portal pressure and also decrease systemic effects and related complications of vasopressin. Their control rate was better than with intravenous administration. Selective infusion of the superior mesenteric artery has been used for the treatment of bleeding varices from that time. However, in some patients infusion of vasopressin is totally unsuccessful and, in our small group of patients, there were three failures. Most of the therapeutic failures in our group, and in that of others have had advanced Child's Group C liver disease. These patients often had hepatofugal flow through arteriovenous shunts within the liver, delivering a high pressure to the portal system and making control more difficult.

More recently, several investigations and clinical studies have questioned the superiority of selective arterial infusion over low-dose intravenous administration for the treatment of variceal bleeding. Barr et al,<sup>12</sup> in a study of 20 dogs, found minimal differences in the hemodynamic effects of selective superior mesenteric artery and intravenous infusion of vasopressin. Low-dose intravenous infusions were almost as effective as arterial infusions in reducing portal pressure and portal venous flow. Athanasoulis et al<sup>13</sup> have given 10 variceal bleeders low-dose intravenous systemic infusions of vasopressin (0.2 to 0.3 units per minute for 48 to 72 hours) with success comparable to arterial infusion. More clinical investigation is required, but intravenous infusion of vasopressin may be as efficacious as arterial infusion for the control of variceal bleeding. Nevertheless, it should be noted that in several published reports the incidence of angiographic identifica-

tion of *arterial* bleeding diagnosed as variceal bleeding ranged as high as 50%.<sup>14</sup> The use of angiography should not be overlooked in making the diagnosis of acutely bleeding varices.

### Conclusions

(1) Angiography of the acutely bleeding patient should be performed as soon as possible for accurate localization of the site of bleeding. The use of barium is contraindicated.

(2) Subselective catheterization and infusion of vasopressin near the site of hemorrhage allows for optimal control, but a trial infusion should be attempted.

(3) If the site of hemorrhage is not visualized on the angiogram, prophylactic infusion of vasopressin is not warranted.

(4) Control of variceal bleeding probably depends on the degree of existing liver disease. Recent investigations suggest that intravenous administration may be as effective as arterial infusion for the control of variceal bleeding.

### References

1. Athanasoulis CA, Brown B, Shapiro JH: Angiography in the diagnosis and management of bleeding stress ulcers and gastritis. *Am J Surg* **125**: 468-473, 1973.
2. Frey CF, Reuter SR, Bookstein JJ: Localization of gastrointestinal hemorrhage by selective angiography. *Surgery* **67**: 548-555, 1970.
3. Nusbaum M, Baum S: Radiographic demonstration of the unknown sites of gastrointestinal bleeding. *Surg Forum* **14**: 374-375, 1963.
4. Nusbaum M, Baum S, Blakemore WS: Clinical experience with the diagnosis and management of gastrointestinal hemorrhage by selective mesenteric catheterization. *Ann Surg* **170**: 506-514, 1969.
5. Stanley RJ, Wise L: Angiography in diagnosis of acute gastrointestinal tract bleeding. *Arch Surg* **107**: 138-144, 1973.
6. Conn HO, Ramsby GR, Storer EH: Selective intraarterial vasopressin in the treatment of upper gastrointestinal hemorrhage. *Gastroenterology* **63**: 634-645, 1972.
7. Rau RM II, Thompson RJ Jr, Simmons CR, et al: Selective visceral angiography in the diagnosis and treatment of gastrointestinal hemorrhage. *Am J Surg* **128**: 160-167, 1974.
8. Nusbaum M, Baum S, Kuroda K, et al: Control of portal hypertension by selective mesenteric arterial drug infusion. *Arch Surg* **97**: 1005-1013, 1968.
9. Nusbaum M, Baum S, Sakiyalak P, et al: Pharmacologic control of portal hypertension. *Surgery* **62**: 299-310, 1967.
10. Baum S, Nusbaum M: The control of gastrointestinal hemorrhage by selective mesenteric arterial infusion of vasopressin. *Radiology* **98**: 497-505, 1971.
11. Kehne JH, Hughes FA, Gompertz ML: The use of surgical pituitrin in the control of esophageal varix bleeding; an experimental study and report of two cases. *Surgery* **39**: 917-925, 1956.
12. Barr JW, Lakin RC, Rösch J: Similarity of arterial and intravenous vasopressin on portal and systemic hemodynamics. *Gastroenterology* **69**: 13-19, 1975.
13. Athanasoulis CA, Waltman AC, Novelline RA, et al: Angiography: its contribution to the emergency management of gastrointestinal hemorrhage. *Radiol Clin North Am* **14**: 265-280, 1976.
14. McCray RS, Martin F, Amir-Ahmadi H, et al: Erroneous diagnosis of hemorrhage from esophageal varices. *Am J Dig Dis* **14**: 755-760, 1969.