HYPEREMIA AS A MEASURE OF VIABILITY IN REvascularized IsCHEMIC INTESTINE

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Intestinal viability after revascularization may be difficult to assess. Commonly used gross visual criteria such as color and vascular pulsation are notably unreliable in predicting viability (1) and no clinically useful objective measure is available. The presence or absence of reactive hyperemia following revascularization of intestinal segments in dogs was investigated with use of radioactive microspheres (2) and correlated with tissue viability.

METHOD

In 14 beagles, vascular supply to a 15-cm segment of ileum was occluded by clamping the mesenteric vascular pedicle and compressing the intramural vessels with rubber bands wrapped around the bowel wall. Each animal received penicillin and streptomycin intramuscularly and was hydrated with normal saline during the course of the study. Following an ischemic period of 4 to 10 hr, the segment was revascu-

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larized by releasing the occluding clamps. Viability was estimated on the basis of color and vascular pulsation 10 min after restoration of blood flow. Albumin microspheres labeled with radioactive technetium ($^{99m}$Tc), 15 to 30µ in size, were injected into the aorta and a rectilinear scan obtained with the bowel spread on a lead plate in order to shield other abdominal radioactivity. The injured segment was judged to be hyperemic, normal, or ischemic by comparing its radiodensity with normal adjacent bowel. In ten dogs a bowel resection with end-to-end anastomosis between normal and injured bowel was performed. Repeat scans were obtained after four days and after one month. Autopsies were performed on animals that died and all survivors were killed at one month.

RESULTS

Five dogs had hyperemic scans and all had viable bowel. Four had normal scans: two had viable bowel, one died of perforation, and one developed a stricture. All five dogs with ischemic scans died of sepsis or perforation within six days. Twelve of the 14 segments initially appeared viable with prompt return of color and vascular pulsation. Four (33%) proved to be nonviable. Three had ischemic scans and one had a normal scan. In addition, a fifth dog developed a severe stricture which would have required resection for survival. Ischemia time alone was a poor predictor of viability. Viable and nonviable bowel was seen in both the 4- and 8-hr occlusion groups. Among the ten dogs that underwent bowel resection, the suture line remained intact in eight. Leaks occurred in two dogs, both with ischemic scans. Scans of the resected specimen confirmed the radioactivity to be within the bowel wall and not in the intraluminal space. After one month three initially hyperemic segments had healed with full mucosal regeneration and a normal scanning pattern. Three dogs with incompletely healed, viable bowel continued to demonstrate hyperemia by scan.

SUMMARY AND CONCLUSION

Reactive hyperemia following revascularization of ischemic intestine was objectively demonstrated by $^{99m}$Tc-albumin microsphere distribution. Viability was accurately predicted by the presence of hyperemia. The absence of hyperemia indicated nonviability. This method is simple and can readily be adapted to intraoperative needs of assessing intestinal viability.

REFERENCES