11.2. Microsphere Distribution in Revascularized Intestine

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The unreliability of gross appearance in determining intestinal viability after an ischemic insult is well recognized. Radioactive microspheres have been used with a high degree of accuracy to objectively predict viability following revascularization (Zarins et al., 1974; Moossa et al., 1974). The behavior of microspheres in normal and revascularized rat intestine was studied by in vivo microscopic observation of the serosa and mesentery and compared to radioisotope activity.

Segmental intestinal ischemia of 1–6 h duration was created in ten rats. Ten minutes after revascularization, 25 ± 5 μm 99mTc-albumin microspheres were injected into the aorta and relative radioactivity was determined. Increased activity in the segment compared to normal adjacent bowel correlated with viability despite significant microcirculatory impairment on observation. Decreased activity indicated nonviability. Albumin microspheres were not visible under the microscope, and further studies were conducted with 15 ± 5 μm, 25 ± 5 μm, 35 ± 5 μm, and 50 ± 10 μm carbonized microspheres using a 85Sr label. Microsphere injection caused a momentary cessation of mesenteric flow and a fall in blood pressure followed by resumption of flow and increased pressure. Microspheres lodged in arterioles according to size, with proximal arteriolar dilatation and logjamming of excess spheres (Fig. 1). Small spheres occluded distal flow, and migration of spheres continued for at least 1 h after injection. Collateral vessels restored flow to the distal bed through the arteriole or retrograde flow in the venule. Large numbers of spheres caused significant microcirculatory impairment and death.

In 15 rats, 100,000 15-μm 85Sr spheres were injected after 1 h of segmental ischemia. In the noninjured intestine, microspheres were evenly distributed in 15–20 μm arterioles. In viable injured intestine, microspheres were present in increased numbers and were correlated with increased (at least twice normal) radioactivity. There was little migration and most microspheres were clumped in 30–40 μm arterioles. Significant microvascular injury was present with arteriolar and venular dilation and...
venous hemorrhage. Segments with radioactivity equal to that in the normal adjacent bowel had more severe microvascular damage and clumped microspheres. Segments that were nonviable with extensive venous hemorrhage had rare microspheres and decreased radioactivity. Increased radioactivity in “hyperemic” viable segments of intestine is due to an increased number of spheres clumped in relatively large arterioles.

**References**
