1989;32:284–289, Virchows Arch A Pathol Anat 1991;419:349–353, Am J Kidney Dis 1995;25:807–809, Am J Nephrol 1996;16:149–153). In the current study, 8 cases of gastrointestinal β_2-microglobulin amyloid deposition were identified over a 10-year period at Brigham and Women's Hospital. The true prevalence of the disease cannot be ascertained from the article because only 24 hemodialysis patients in whom gastrointestinal tissue was available were studied and the total number of patients undergoing long-term hemodialysis is not reported. It is almost certain that dialysis-related amyloidosis is underreported because of failure to entertain the diagnosis in patients on hemodialysis who have gastrointestinal bleeding, abdominal pain, diarrhea/malabsorption, or pseudo-obstruction and failure to obtain premorbid biopsy specimens of the rectum, stomach, and duodenum. It is not known whether the reported yields of >80% for rectal, gastric, and/or duodenal biopsies in diagnosing AA and AL amyloid (Gastrointest Endosc 1990;36:10–14, Mayo Clin Proc 1993;68:763–767) are applicable to β_2-microglobulin amyloid where deposition occurs preferentially in deeper tissues, i.e., in small arteries and interstitia of the muscularis mucosa, submucosa, and muscularis propria (Ann Rheum Dis 1997;56:535–541, J Clin Pathol 1997;50:873–875). Deeper biopsies, performed by a suction tube, might be most productive. Similar caveats pertain to the use of subcutaneous abdominal fat aspiration (Arch Intern Med 1983;143:1549–1552) and radioscintigraphy with technetium Tc 99m pyrophosphate (Am J Cardiol 1984;54:1150–1151), technetium-labeled aprotinin (Eur J Nucl Med 1995;22:1393–1401), and iodine 123–labeled serum amyloid P component (N Engl J Med 1990;323:508–513), which have been useful for diagnosing and imaging certain types of amyloid depositions (e.g., AA and AL), but have not been validated in dialysis-related amyloidosis.

Once dialysis-related amyloidosis is diagnosed, several treatment options are available including renal transplantation and use of high-flux (i.e., more porous) biocompatible hemodialysis membranes (Kidney Int 1991;39:1012–1019, Nephrol Dial Transplant 1997;12:655–657). Renal transplantation normalizes plasma β_2-microglobulin levels and alleviates articular complaints. High-flux biocompatible hemodialysis membranes remove and adsorb β_2-microglobulin more efficiently than conventional cellulosic membranes (J Am Soc Nephrol 1997;8:509–514). Although symptomatic deposition of β_2-microglobulin amyloid in the gastrointestinal tract of dialysis patients constitutes an indication for the application of these modalities, there are no definitive studies to indicate that transplantation or dialysis with high-flux membranes can cause resolution of the amyloid deposits, prevent further progression of the disease, or alleviate symptoms in patients with β_2-microglobulin amyloidosis of the gastrointestinal tract.

In summary, amyloidosis is by no means rare and may be associated with disease in virtually every organ, including the gastrointestinal tract. In patients undergoing long-term dialysis, especially for >10 years, symptomatic deposition of β_2-microglobulin amyloid is frequently observed in bones, joints, and soft tissues. Gastrointestinal tract involvement is probably underreported and should be considered in any long-term dialysis patient who presents with bleeding, diarrhea, abdominal pain, or pseudo-obstruction; ischemic changes, including surface denudation and ulceration, are common. Gastric, duodenal, or rectal biopsies are essential to make the diagnosis. Rational treatment comprises the use of high-flux biocompatible dialysis membranes and/or renal transplantation.

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Reply. We thank Drs. Mogyorosi and Schubert for their thoughtful review of our study. As they correctly point out, histological examination is presently the only means by which extraskeletal β_2-microglobulin amyloid deposition can be identified. Thus, diagnosis and clinical recognition of gastrointestinal β_2-microglobulin amyloid deposition has lagged behind that of other amyloid deposition diseases.

The relative lack of awareness of gastrointestinal β_2-microglobulin amyloid deposition may also be due to the absence of specific clinical signs of the disease. Our study identified an association between increased length of time of hemodialysis treatment and the presence of gastrointestinal β_2-microglobulin amyloid deposits. All but 1 of the patients with gastrointestinal β_2-microglobulin amyloid deposition had been undergoing hemodialysis for more than 10 years. This was the only clinical feature significantly associated with the presence of gastrointestinal β_2-microglobulin amyloid. Thus, at present, a history of hemodialysis for more than 10 years in a patient presenting with gastrointestinal complaints should cause one to consider gastrointestinal β_2-microglobulin amyloid deposition in the differential diagnosis. While nonspecific, the presence of gastrointestinal bleeding may also heighten concern that β_2-microglobulin amyloid deposition may be present.

Once the diagnosis of gastrointestinal β_2-microglobulin amyloid deposition has been considered, a false-negative tissue diagnosis may still occur. The frequency of false-negative diagnoses may depend on whether the tissue specimen evaluated was a biopsy or transmural resection or the site from which it was obtained. Although our study is the largest presently available, the number of patients and tissues available were inadequate for detailed analyses of the sensitivity with which biopsy and resection specimens can be used to detect gastrointestinal β_2-microglobulin amyloid. However, it is notable that β_2-microglobulin amyloid was detected nearly 4 times more often in resection specimens than in biopsy specimens. We did not have more than 1 specimen from any patient with β_2-microglobulin deposition; thus it was not possible to compare involvement of various regions of the gastrointestinal tract in a single patient, but β_2-microglobulin amyloid was identified in stomach, small bowel, and colorectum. Because the apparently increased sensitivity of detection in resection specimens may reflect the involvement of submucosal vessels, which may not be present in biopsy specimens, the need for deep biopsies should be kept in mind when attempting to identify β_2-microglobulin amyloid by biopsy. Finally, false-negative diagnoses may be diminished if the suspicion of β_2-microglobulin amyloid deposition is communicated to the pathologist. In our series, amyloid deposition was initially reported in only 63% of the positive cases. Given that the deposits can be extremely subtle on routine H&E stains, alerting the pathologist can greatly aid in detection of β_2-microglobulin amyloid and allow the pathologist to use Congo red stain and β_2-microglobulin immunostain in appropriate cases.

Drs. Mogyorosi and Schubert note that the prevalence of gastrointestinal involvement by β_2-microglobulin amyloidosis is unknown. We hoped to address this issue, but it was difficult to determine the appropriate denominator for the 8 patients in our study with gastrointestinal β_2-microglobulin amyloid deposition. At the extremes, one might use either the total number of hemodialysis patients or the total number of patients whose biopsy specimens we studied. The former would imply a disease prevalence of less than 1%, and the latter would suggest a prevalence of 33% of hemodialysis patients. Each of these numbers is certainly flawed, and the true prevalence is probably somewhere in between. However, either

number suggests that this entity may be far more common than previously appreciated.

If careful consideration is given to the possibility of gastrointestinal β_2-microglobulin amyloid deposition, future studies may give an accurate assessment of the prevalence of this disease. More importantly, increased recognition and diagnosis of this disease will allow for better understanding of the pathogenesis and successful treatment of gastrointestinal β_2-microglobulin amyloidosis.

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SURGEON–RELATED FACTORS AND OUTCOME IN RECTAL CANCER

Porter GA, Soskolne CL, Yakimets WW, Newman SC (Departments of Surgery and Public Health Sciences, University of Alberta, Edmonton, Canada). Surgeon-related factors and outcome in rectal cancer. Ann Surg 1998;227:157–167.

Porter et al. sought to evaluate whether outcomes after surgery for rectal carcinoma were affected by specialty training in colorectal surgery or the surgeon's case volume. They reviewed records of patients undergoing potentially curative low anterior resection (LAR) or abdominoperineal resection (APR) for primary rectal adenocarcinoma at the 5 general hospitals in Edmonton. All 683 patients so treated between 1983 and 1990 were included to obtain information about short-term outcomes and long-term recurrence and survival rates. Fifty-two surgeons were involved. Five of them had received some fellowship training in colorectal surgery after finishing a general surgery residency. The number having completed training or certified in the subspecialty of colorectal surgery was not identified. For the other 47 surgeons, details about training, certification, and levels of experience were not given.

The 5 "colorectal-trained" surgeons were responsible for treating 109 (16%) of the patients in the study. There were no differences in age, sex, or presentation with obstruction or fixation between their patients and those treated by other surgeons. The colorectal-trained surgeons treated significantly more patients with lesions located in the lower third of the rectum (26% vs. 16%) and significantly less patients with lesions in the middle third of the rectum (36% vs. 55%). There were no apparent differences in tumor size, differentiation, extent of vascular/neural invasion, or cancer stage, both groups of surgeons seeing patients with about 20% stage I, 40% stage II, and 40% stage III cancer (TNM system). When patients were analyzed according to the surgeon's case volume ($<$21 resections during the 7-year study period vs. $\geq$21 resections), no apparent differences in tumor location, size, presentation, pathological characteristics, or stage were found. Also, when analyzed for training record or case volume, there were no differences in the proportion of patients who underwent adjuvant therapy (30%–38%).

In analyzing by training record or case volume, the following differences were observed: First, surgeons with more experience performed the operation faster (mean, 140 $\pm$ 44 minutes) than those who did less than 21 resections (mean, 174 $\pm$ 52 minutes; $P < 0.001$). Surgeons with colorectal training experience were able to save the anal sphincters, that is, avoid APR, in 73% of patients, whereas those who had not had such training experience performed LAR in 53% of their patients ($P < 0.001$). Analyzing by case volume, surgeons with higher volume performed LAR in 61%, whereas those with $<$21 resections performed LAR in 51% of their patients. When analyzed for intraoperative occurrences such as tumor spillage or inadvertent rectal perforation, there were no differences associated with training record or case volume.

In long-term outcomes, the investigators found that training record and case volume were associated with differences in local recurrence (LR) and 5-year, disease–specific survival (DSS, Kaplan–Meier method). Patients treated by surgeons without a training record and low case volume had an LR of 45% and 5-year DSS of 39%. Patients treated by surgeons with such training and higher case volume had LR of 10% and 5-year DSS of 67%. Patients treated by surgeons with a training record and lower case volume, or by surgeons without a training record but higher case volume, had similar LR (27% and 21%, respectively) and DSS (55% and 49%, respectively). In other respects, univariate analysis showed that LR and DSS were significantly affected by age, complication of obstruction, tumor location, stage, histology, transfusion requirement, and intraoperative tumor spill/rectal perforation. In Cox proportional hazard regression models, local recurrence and disease-specific mortality were significantly associated with colorectal training record and case volume. The authors concluded that a record of postresidency colorectal training and higher case volumes were independently associated with lower rates of local recurrence and lower disease-specific mortality rates.

Comment. The commonsense conclusion of this report is that surgeons who have postresidency training in colorectal surgery and do a minimum case volume (average of 3 resections per year) will achieve the best long-term results for their patients. How much argument could there be?

Not much. But before agreeing that this article has made its case for referring patients with rectal carcinoma only to subspecialists, it is worth noting how surgical procedures for carcinoma of the lower and middle third of the rectum may be different from other complex procedures. It is well recognized that volume affects perioperative mortality in areas such as coronary artery bypass (JAMA 1987;257:785–789), trauma care (Am J Surg 1995;170:333–340), and pancreaticoduodenectomy (Ann Surg 1995;222:638–645). Cardiac surgeons, and their referring cardiologists, have long argued that a certain threshold level of case volume is necessary for acute morbidities and mortality rates to be maintained at acceptable levels (JAMA 1987;257:785–789). Interestingly, more recent reports (JAMA 1995;273:209–213, Ann Thorac Surg 1996;61:21–26) have suggested that the threshold for obtaining acceptable results has become lower, so that cardiac surgery programs need only perform 100 cases per year to maintain acceptable morbidity/mortality statistics. These findings were interpreted as largely reflecting improvements in institutional systems of care. Perhaps the exodus of low-volume surgeons who were identified as high outliers also played a part (JAMA 1995;273:209–213). But the message was that accurate analysis and reporting of