

Novel Use of Endoscopic Clips as Fiducials for Radiotherapy in Small Bowel Lymphoma

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Abstract

A 31-year-old woman was diagnosed with duodenal grade 1 follicular lymphoma. The patient underwent radiotherapy and on surveillance enteroscopy, the lymphoma was persistently identified in the duodenum and jejunum. Endoscopic clips were used as fiducials to better localize the tumor during radiotherapy. Endoscopic clips are increasingly used as tumor localization tools because of their favorable risk-benefit ratio. In our case, endoscopic clipping was necessary to properly localize the tumor after prior treatment failure, and the patient now has no evidence of disease. Larger studies are needed to demonstrate the efficacy of clips in tumor localization and improved disease-related morbidity.

Introduction

Endoscopic clips are frequently used to effect hemostasis in the setting of gastrointestinal bleeding. Since inception, the indication for their use has been expanded to include demarcation of tumor boundaries to guide oncologic therapies. We describe the use endoscopic clips as fiducials to improve the radiotherapeutic treatment of small intestinal lymphoma.

Case Report

A 31-year-old woman raised near the Ukraine during the Chernobyl nuclear reactor disaster presented with non-bloody diarrhea, pyrosis, and abdominal pain. Esophagogastroduodenoscopy (EGD) displayed multiple sub-centimeter white nodules in the second portion of the duodenum. Biopsies revealed follicular lymphoma grade 1. Computed tomography (CT), positron emission tomography (PET) scan, and bone marrow biopsy confirmed that the disease was limited to the duodenum. Further staging with wireless capsule endoscopy revealed multiple nodular lesions localized to the fourth portion of the duodenum and proximal jejunum. Given the perceived superiority of direct endoscopic visualization and PET in tumor localization, and the predictable, fixed location of the duodenum, further marking to direct the radiation beam was not performed.

The patient underwent 20 fractions of radiotherapy to a total dose of 3,600 cGy. On surveillance push enteroscopy, the lymphoma was again identified in the fourth part of duodenum and proximal jejunum. Given the nearly universal responsiveness of this lymphoma to radiotherapy, the decision was made to use endoscopic clips as fiducials to better localize the tumor during subsequent therapy; a clip was placed proximal to the duodenal lesion, and 2 clips were placed distal to the jejunal lesions (Figure 1). After repeat radiation simulation, it was noted that a portion of the demarcated lymphomatous mucosa lay outside the previously irradiated field. A second

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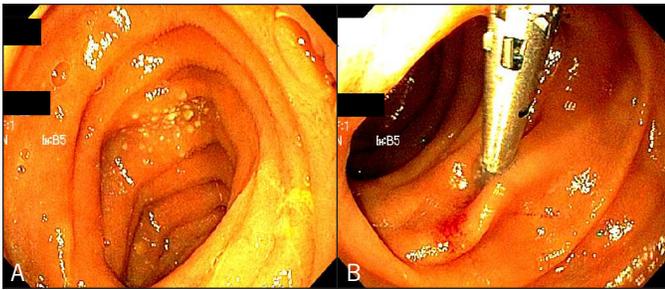


Figure 1. (A) Endoscopic images demonstrating multiple sub-centimeter white nodules in jejunum, histologically confirmed as follicular lymphoma. (B) One clip was placed proximal to the duodenal lesion, and 2 clips were placed distally to the jejunal lesions, permitting localization and orientation during subsequent pre-radiation CT simulation.

course of 20 fractions of radiotherapy with a total dose of 3,600 cGy was administered with a 1-cm overlap with the first radiation treatment (Figure 2). This 1-cm overlap between the 2 radiation treatments would be the area at greatest risk for radiation-induced damage; however, there is little chance of dose-dependent radiation damage at 3,600 cGy. The patient achieved complete remission and currently has no evidence of disease on surveillance enteroscopy.

Discussion

Chernobyl nuclear disaster radiation exposure is associated with gastrointestinal malignancies, including gastric carcinoma, colon cancer, non-Hodgkin's gastric lymphoma, sclerosing epithelioid fibrosarcoma of the cecum, and Krukenberg tumor arising from the gastroesophageal junction.¹⁻⁵ A causal relationship has not been determined, as the comparative incidence for these tumors in relation to those not exposed to radiation is unknown.

As in other cancers, patients with primary follicular lymphoma of the gastrointestinal tract usually undergo imaging procedures to localize the tumor area in preparation for radiotherapy.⁶ However, localizing the diseased area can be complex, and inaccurate localization may result in radiation of normal tissue with complications such as fibrosis and damage to adjacent tissues.⁷⁻⁸ Poor tumor localization can also result in application of the radiotherapy beam outside tumor margins and inadequate treatment of disease.⁹ Endoscopic clips, originally developed for hemostasis of gastrointestinal bleeding, are being increasingly used for tumor localization, as advances in endoscopic devices have resulted in improved delivery of fiducial devices in a relatively inexpensive, easy, and safe manner.^{8,10}

Several articles were published over the last 2 decades describing endoscopic clipping as a tool for localization in

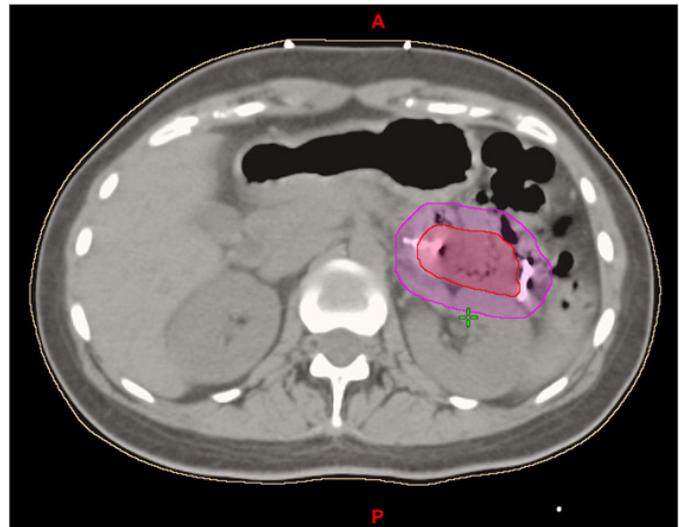


Figure 2. CT simulation. The red volume represents the gross tumor volume while the magenta represents the PTV (planning target volume), which accounts for error due to motion and technique. Note the location of the single proximal clip and dual distal clips, acting as fiducials for future radiation. A portion of the demarcated lymphomatous mucosa lay outside the previously irradiated field.

preoperative and pre-radiotherapy planning in luminal tumors, including 3 esophageal and 1 gastric neoplasia,⁶⁻⁹ several reports with colorectal tumors,¹¹⁻¹³ and, recently, a prospective study of 15 patients using endoscopically placed clips for tumor localization during CT gastroscopy and preoperative planning.¹⁴ Only 1 prior report describes duodenal follicular lymphoma tumor localization using endoscopic clips.¹⁵ At present, there are no randomized clinical trials demonstrating the efficacy of using fiducial markers in targeting radiotherapy for duodenal lymphomas. However, there are multiple trials for prostate cancer and anecdotal evidence for upper gastrointestinal tract malignancies that substantiate the use of fiducial markers for tumor localization, and their benefit for small bowel lymphomas merits further research.¹⁶⁻¹⁸ Larger studies should be done to demonstrate their efficacy in accurate approximation of tumor boundaries with associated decrease in treatment and disease-related morbidity.

Disclosures

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