

# Diagnosis and Management of Clip Artifact on Endoscopic Mucosal Resection Scars

Douglas K. Rex, MD

Division of Gastroenterology/Hepatology, Indiana University School of Medicine, Indianapolis, Indiana

Corresponding author:  
Dr Douglas K. Rex  
550 N. University Blvd  
Suite 4100  
Indianapolis, IN 46202  
Tel: (317) 948-8741  
E-mail: [drex@iu.edu](mailto:drex@iu.edu)

**Abstract:** Delayed hemorrhage is the most common complication of endoscopic mucosal resection (EMR). Studies have shown that prophylactic placement of hemostatic clips on certain EMR scars reduces the risk of delayed hemorrhage. During endoscopic follow-up, mucosal distortions induced by clip closure known as clip artifact can be visualized. Clip artifact can be confused with residual neoplastic polyp, potentially leading to unnecessary treatment and complications. Clip artifact can be classified into 3 different types: Type 1: the presence of inflammation associated with continued clip attachment; Type 2: the presence of inflammation that persists after clip detachment; and Type 3: the presence of noninflamed mucosal distortions after clip detachment. Differentiation of clip artifact from residual neoplasia relies on careful analysis of colonic pit patterns. Management varies greatly; clip artifact requires no treatment, whereas residual polyp requires resection. This article reviews clip artifact and introduces a classification scheme to help endoscopists with diagnosis and management.

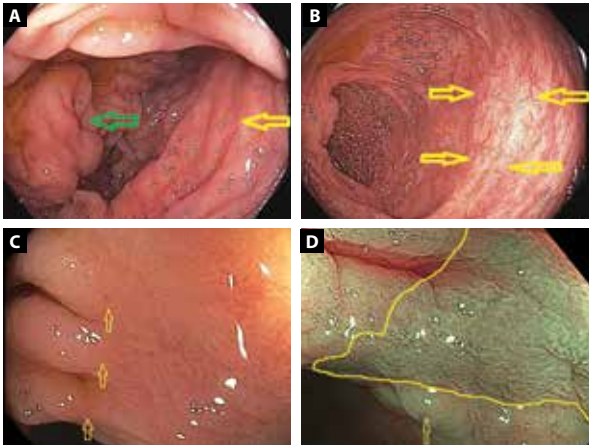
## Efficacy of Clip Closure After Endoscopic Resection of Colorectal Lesions

Delayed hemorrhage is the most common complication of endoscopic mucosal resection (EMR) and is associated with larger polyp size, proximal colon location, use of electrocautery, and continuation of anticoagulation and antiplatelet agents.<sup>1</sup> Randomized controlled trials<sup>2,3</sup> and a historically controlled study<sup>4</sup> have shown that prophylactic clip closure of EMR scars reduces delayed hemorrhage. These trials, along with a meta-analysis,<sup>5</sup> have identified that lesions that are greater than or equal to 20 mm, proximal to the splenic flexure, and removed with electrocautery have a lower risk of delayed bleeding after clip closure. Whether additional lesions that are either smaller or located in the left colon should be treated with prophylactic clip closure in patients undergoing re-anticoagulation or continuation of antiplatelet agents after EMR remains uncertain.<sup>6</sup>

Moreover, prophylactic clipping or placement of detachable loops has been suggested for pedunculated polyps with large heads and/or thick stalks.<sup>7,8</sup> Placement of these devices prior to transection of the polyp stalk may increase the risk of an adverse oncologic outcome by forcing the snare up toward the polyp head and possibly across any cancer that might be present in the stalk.<sup>9</sup> In addition, placement of clips prior to transection was associated with an increased risk of delayed hemorrhage in a

### Keywords

Endoscopic mucosal resection, hemostatic clips, postpolypectomy hemorrhage, clip artifact



**Figure 1. A:** Proximal right colon at follow-up after EMR of a 40-mm adenoma. The green arrow indicates ileocecal valve. The yellow arrow indicates a flat scar without clip artifact, which is imperceptible in a deflated colon.

**B:** The same area shown in **A** with a flat white scar (arrows) now clearly visible in the gas-distended colon.

**C:** A flat scar 6 months after EMR in white light with optical magnification. To the left of the arrows are normal colonic folds, which end abruptly at the scar edge (arrows). The scar is to the right of the arrows and has no recurrent polyp, but an altered pit pattern from normal is evident.

**D:** The same scar seen in **C** but in narrow-band imaging with optical magnification. The scar is inside the yellow line. Note that the colonic pits are large and, in this case, darker than the pits of the normal colonic mucosa (arrow).

EMR, endoscopic mucosal resection.

retrospective multivariable analysis of a large multicenter Japanese database.<sup>10</sup> Further, prophylactic clipping prior to transection has been associated with thermal injury to the bowel wall.<sup>11</sup> There is uncertainty as to whether closure of the polypectomy defect after transection of pedunculated polyps is effective in preventing delayed bleeding.<sup>10</sup> However, my own preference for removal of large pedunculated polyps is snare transection low on the stalk using forced coagulation current followed by clip closure of the polypectomy site.<sup>9</sup>

Although prophylactic placement of hemostatic clips to prevent delayed hemorrhage is effective for select indications, their use can lead to mucosal distortions evident upon follow-up.<sup>12-14</sup> If these distortions are interpreted as residual polyp, it may lead to unnecessary and potentially risky treatments. Therefore, the ability to recognize clip artifact and manage it appropriately is important for endoscopists using prophylactic clip closure. This article reviews clip artifact and introduces a classification scheme to help endoscopists with diagnosis and management. Awareness of and experience with the clip artifact

phenomenon allows for differentiation of clip artifact from residual polyp with essentially complete accuracy. Although residual polyp should be aggressively removed, clip artifact can be left alone or subjected to cold biopsy sampling.

### Characteristics of Endoscopic Mucosal Resection Scars

If clips are not used to close EMR defects, normal EMR scars without residual polyp appear flat (Figure 1A, 1B). These are best identified at colonoscopic follow-up by aggressive gas distention of the colon, which accentuates the color contrast between the scar, which is white in color, and the surrounding normal mucosa, which is salmon or red in color (Figure 1B). When the colon is deflated, the color contrast between the scar and normal colon is reduced. Reviewing photographs from the previous EMR report facilitates scar location. Notation of the position of the polyp or EMR defect at the time of resection in relation to any tattoos or anatomic landmarks is useful for scar location at follow-up.<sup>15</sup> In a recent large prospective study, EMR scars were identified by experts in nearly 100% of cases, even in the absence of tattoos.<sup>15</sup> Scar formation typically disrupts the shape of adjacent normal colonic folds, which end abruptly at the scar edge (Figure 1C, 1D).

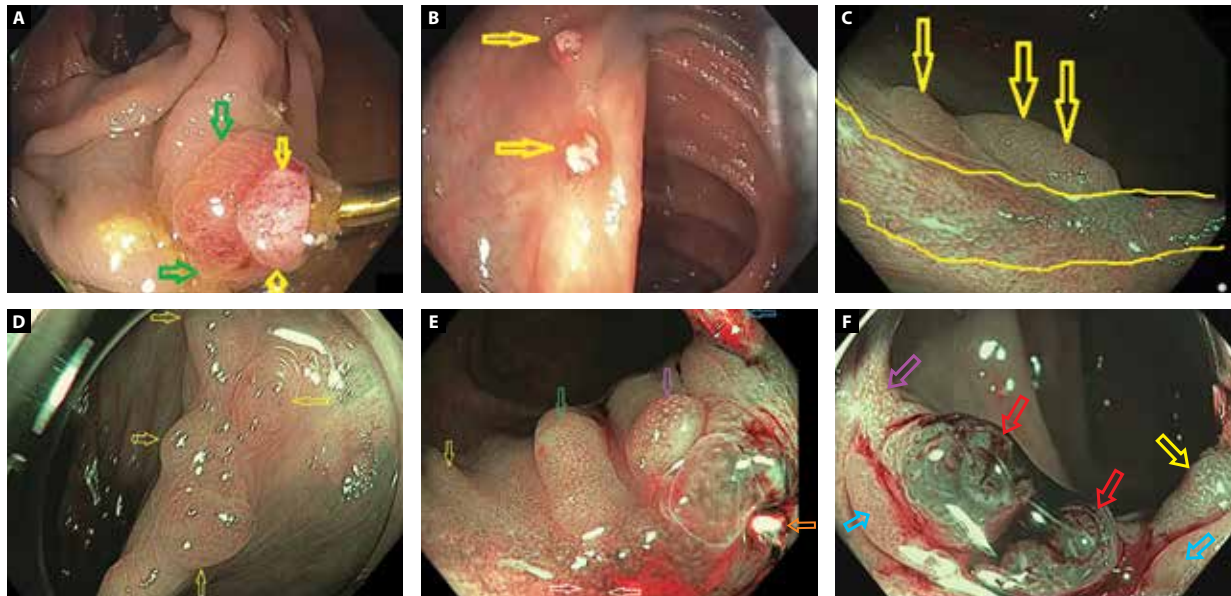
### Types of Clip Artifact

Type 1 clip artifact is enlarged and inflamed tissue at the base of a retained clip on the EMR scar (Figure 2A). When follow-up is conducted at 6 months, approximately 5% to 10% of placed clips are still attached to the scar, depending on the type of clip used.<sup>13</sup> These clips may have a mound of associated tissue with variable amounts of inflammation, and sometimes granulation tissue (ulceration) at the immediate base of the clip (Figure 2A).

Type 2 clip artifact resembles Type 1 artifact except the clip is no longer attached to the EMR scar (Figure 2B).

Type 3 clip artifact is characterized by mucosal distortion without evidence of inflammation and with a normal colonic pit pattern. Type 3 artifact may result from progressive loss of inflammatory change in Type 2, or from simple mucosal traction caused by the pulling effect and subsequent scarring associated with closure of the clip jaws (Figure 2C-F).

The overall incidence of clip artifact at first follow-up is 35% to 40%.<sup>12</sup> This means that, in most instances, the clips detach from the defect before they result in inflammation, scarring, and distortion. Persistent polyp is rarely seen at the base of attached clips, as long as the polyp appears to have been completely removed during the



**Figure 2. A:** Type 1 clip artifact. The attached clip is the gold-colored object at the lower right. The green arrows point to a mound of inflammatory tissue. In some instances of Type 1 artifact, the actual clip base (yellow arrows) has ulceration and granulation tissue.

**B:** Two mounds of Type 2 clip artifact (arrows) on a proximal colon EMR scar. Inflammation is present and central ulceration (as seen here) can sometimes occur. Type 2 is similar to Type 1, but the clip has detached from the site.

**C:** Type 3 clip artifact (arrows) seen in narrow-band imaging with optical magnification. Note the normal colonic pit pattern (small, uniform-sized white dots) on the bumps of the clip artifact. The scar is between the yellow lines. There is no recurrent polyp, but the pits in the scar are larger than those on mature Type 3 clip artifact and larger than normal flat colonic mucosa. These changes are typical in normal scar tissue without residual polyp.

**D:** Four bumps of Type 3 clip artifact on an EMR scar (arrows) seen in narrow-band imaging with optical magnification. Note that the pit pattern of small, uniform-sized white dots is very similar to the surrounding normal mucosa.

**E:** An EMR scar at 6 months seen in narrow-band imaging with optical magnification. There is no recurrence. The blue and orange arrows denote attached clips. The clip at the blue arrow has limited adjacent clip artifact, but the clip at the orange arrow has adjacent Type 1 clip artifact with large round and oval inflammatory pits (within the area circled in white). The yellow arrow denotes normal mucosa with normal, small white pits. The green arrow indicates Type 3 clip artifact with near normal pit structure. The purple arrow also shows Type 3 clip artifact, although the pits are slightly larger and the vessels around the pits are darker, likely representing resolving inflammation. Note that the flat scar (white arrows) also has larger than normal pits, but they are round and fairly uniform in size and, thus, nonneoplastic.

**F:** An EMR site seen in narrow-band imaging with optical magnification at 6 months demonstrating all 3 types of clip artifact. The yellow arrow shows Type 1 clip artifact seen on a mound of tissue surrounding an attached clip visible at the right edge of the image. Note the larger than normal but mostly uniform-sized pits. The red arrows show Type 2 clip artifact with enlarged nonneoplastic colonic pits. Note that the pits in the flat scar (purple arrow) are also larger than normal colonic pits, but round and uniform in size (nonneoplastic). The blue arrows indicate Type 3 clip artifact.

EMR, endoscopic mucosal resection.

initial procedure.<sup>13</sup> The type of clip artifact encountered will depend on whether the clips are still attached and the time period between when they detached and when the scar is observed.

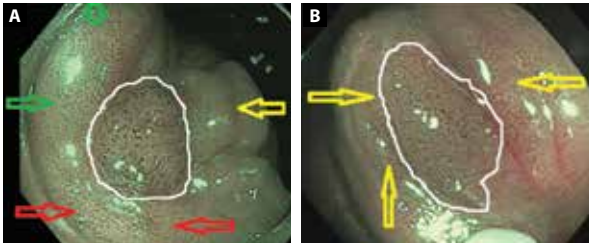
### Pit Pattern Analysis

Differentiation of clip artifact from recurrent polyp is completely dependent on pit pattern analysis.<sup>16</sup> Accurate

analysis is assisted by the use of electronic chromoendoscopy and magnification.

Endoscopists should first be able to recognize the pit pattern of normal colonic mucosa, which demonstrates small, uniform-sized round pits, usually white in color but sometimes dark (Figure 1D, 2C).

It is critical to understand that the pits in a normal scar without residual polyp often appear larger than those of the normal mucosa (Figure 2C-F). However, the



**Figure 3. A:** A 4-mm residual or recurrent adenoma (within the area circled in white) on an EMR scar seen at 6 months using narrow-band imaging with optical magnification. The green arrows indicate a normal mucosal fold adjacent to the scar. Note the normal pattern of small, uniform-sized white pits. The yellow arrow denotes Type 3 clip artifact demonstrating normal colonic pits. The red arrows show flat normal scar demonstrating pits that are slightly larger than normal but uniform in size. The recurrence (within the area circled in white) demonstrates a NICE 2 pattern consistent with adenoma.

**B:** Recurrent adenoma (within the area circled in white) on an EMR scar at 6 months seen using narrow-band imaging with optical magnification. The lesion demonstrates a NICE 2 pattern consistent with adenoma. The arrows point to the slightly elevated mucosal distortions consistent with Type 3 clip artifact.

EMR, endoscopic mucosal resection; NICE, Narrow-Band Imaging International Colorectal Endoscopic classification.

pits are still uniform in size and round in shape. These enlarged pits likely reflect persistent inflammation during healing and tend to become less prominent over time.

Similarly, larger than normal but still round pits are typically evident on the mounds of tissue in Type 1 and Type 2 clip artifact (Figure 2A, 2F). These pits are distinct from both residual adenomatous pits (Figure 3A, 3B) and serrated pits. Differentiating serrated pits from clip artifact is becoming less of a problem with the conversion of serrated resection to cold EMR (EMR without electrocautery), which does not require prophylactic clip closure.<sup>17</sup>

### Management of Clip Artifact

Although the need for cold biopsy of EMR scars with no evidence of recurrence may be unnecessary in the era of high-definition imaging and magnification, research employing routine biopsy of scars with no visible abnormal pits demonstrates a low percentage of cases with histologically persistent dysplasia or persistent sessile serrated lesion.<sup>18</sup> Endoscopists who routinely take biopsies of EMR scars can include biopsies of clip artifact with biopsies of flat scar and place them in the same formalin bottle for histologic examination. There is no evidence

that biopsy of clip artifact is more likely to yield a diagnosis of histologically evident residual polyp compared with biopsies from a normal-appearing flat scar. A minor advantage of including the bumps of clip artifact in biopsies is that the bumps of artifact tissue often appear less prominent at the next follow-up. We typically wait 1 year or longer before re-examination of scars that are flat or have only clip artifact. If the biopsies at first follow-up are negative for recurrent polyp, the risk of recurrent overt polyp at subsequent follow-up is 2.7%.<sup>18</sup> If the biopsies of an EMR scar without overt recurrence are positive for residual polyp, the risk of overt residual polyp 1 year later is 27%.<sup>18</sup> In the case of histologic-only recurrence detected by biopsy, we still wait 1 year to perform the second follow-up examination to allow any residual polyp to grow into an overt recurrence that can be targeted for endoscopic therapy. If overt recurrent polyp is seen at any follow-up, it can be successfully resected endoscopically in nearly all cases.<sup>18,19</sup> Hot snare resection (usually without injection), or hot avulsion followed by thermal injury of the resection margin<sup>17</sup> are effective treatments for residual polyp.

### Summary

Clip artifact is common after EMR sites are treated with prophylactic clip closure. Clip artifact can be classified into 3 distinct types, depending on the presence of remaining clips and the presence or absence of persistent inflammatory change. Pit pattern analysis accurately differentiates clip artifact from residual polyp in essentially all cases. If endoscopists take biopsies of normal-appearing scars at EMR follow-up, it is reasonable to include biopsies of clip artifact along with biopsies of normal-appearing flat scar in the specimen container submitted to pathology. However, there is currently no evidence that clip artifact is more likely to yield a diagnosis of histologic-only recurrence compared with biopsy of flat scar. Biopsy of clip artifact does lead to a reduction in the prominence of clip artifact at subsequent follow-ups.

### Disclosures

*Dr Rex has served as a consultant for Olympus Corporation, Boston Scientific, Aries Pharmaceuticals, Braintree Laboratories, Norgine, Endokey, GI Supply, and Medtronic; he has received research support from Olympus Corporation, Medivators, Erbe USA Inc, and Braintree Laboratories; and he has been a shareholder of Satisfai Health.*

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(Continued on page 484)

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