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A step-by-step guide to approaching colon polyps

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ABSTRACT

Colorectal cancer (CRC) is considered one of the most prevalent cancers among Iranian men and women (1). Colorectal polyps, known as precursors of CRCs, are of great importance. Surveillance, locating, and removal of colorectal polyps make them the most modifiable factor apart from other genetic and environmental factors leading to CRCs. Colorectal polyps are defined as outpouchings from superficial and deep layers of mucosa of the colonic wall. They are classified as adenomas, serrated polyps, hyperplastic polyps, and hamartomas based on histological evaluation. Submucosal invasion precludes the possibility of endoscopic resection and should be ruled out via colonoscopic evaluation (2). Knowing this significance, the present study aims to present a brief review on classification, probability of endoscopic resection, complications of endoscopic polypectomy, as well as proper surveillance after polypectomy.

Keywords: Colorectal polyps, Paris classification, JNET classification, NICE classification, Kudo pit pattern, Deep mural injury.
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Case 1

A 58-year-old woman was referred to the office for screening colonoscopy as an average-risk individual for CRC. Her colonoscopy was notable for an approximately 20 mm pedunculated polyp in the sigmoid colon. The stalk was estimated to be 10 mm in diameter (Figure 1). Another large, flat lesion with a diameter of 30 mm was detected in the transverse colon (Figure 2). Total colonoscopy was performed. The bowel preparation was compatible with Boston Bowel Preparation Score (BBPS)= 3 in each part of the colon which is indicative of a high quality preparation in each segment of colon.

For managing colorectal polyps, it is firstly suggested to precisely describe the location, distribution, size, and shape of the polyps.

The best accepted classification for appearance of colorectal polyps is Paris classification (Figure 3). Based on this classification, mucosal lesions fall into three groups. Type I lesions are protruded into the lumen, type

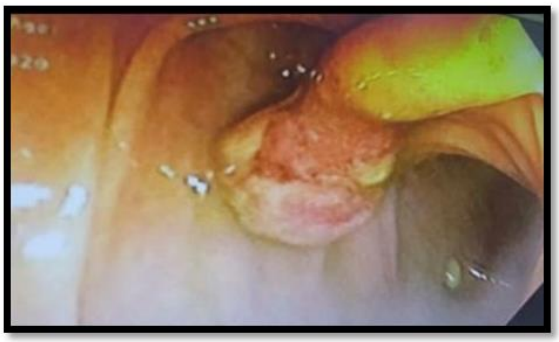

Figure 1. A pedunculated polyp measuring about 20mm in head and 10mm in stalk in sigmoid colon

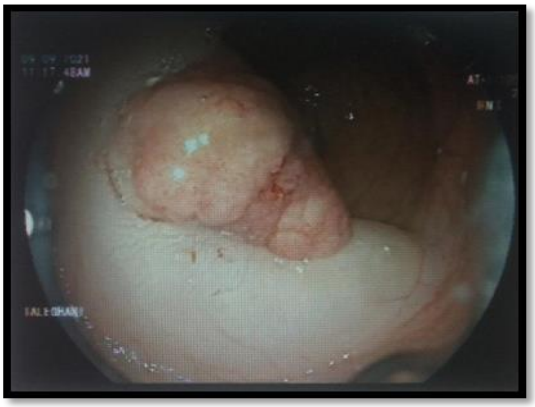

Figure 2. A 30mm flat lesion in transverse colon

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II lesions are at the level of mucosa and finally, type III lesions are predominantly excavated or ulcerated (3).

Specifically, type I lesions are polypoid and stratified into three categories of pedunculated (Ip), semipedunculated (Isp), and sessile (Is) polyps. To differentiate sessile polyps from type II lesions, the height of the lesion should be taken into account, which is estimated to be greater than that of the closed forceps (about 2.5 mm) for type Is lesions in contrast to the height of flat lesions, which are less than 2.5 mm. Flat lesions appear to be slightly elevated (IIa), completely flat (IIb) or slightly depressed (IIc). The term flat elevated is applied to the lesions when the height of the lesion is less than 2.5 mm. Depressed lesions fall into the type IIc category when the depth of the lesion is less than 1.2 mm. Excavated or ulcerated lesions are labeled as type III when their depth is below 1.2 mm in the mucosa. Paris classification of colon polyps has been depicted in Figure 3 (4).

It seems that the first polyp detected in the sigmoid colon of the presented case is type Ip (Figure 1) based on Paris classification as noted above. However, what if we wanted to define the second lesion detected in the transverse colon: It is widely accepted that they are flat lesions but they cannot definitely reflect the characteristics of Is or II lesions. Indeed, they are classified as laterally spreading lesions (LSLs) (5). With regard to the Paris classification, LSLs are type Is or II lesions extending superficially larger than 10 mm in width. They are divided into two groups of granular and non-granular lesions. Granular lesions could be nodular dominant or homogenous. Non-granular lesions would be with or without pseudodepression (Figure 4) (6, 7).

Influenced by LSL classification, there is a nodular dominant granular LSL in the transverse colon of the presented case (Figure 2). Now, it is time to move to the next level, which is making decision for removal of the detected polyps:

The next step is to decide to pursue an endoscopic polypectomy if it is not contraindicated. To proceed with a successful polypectomy, submucosal invasion should be excluded.

Although not definitely accurate, there are some visual techniques using indigo carmine dye or narrow band imaging (NBI), which distinguish submucosal invasion from mucosal involvement. The most acceptable classifications are NICE (NBI international colorectal endoscopic), JNET (Japan NBI expert team) and Kudo's (requiring indigo carmine) classifications (8).

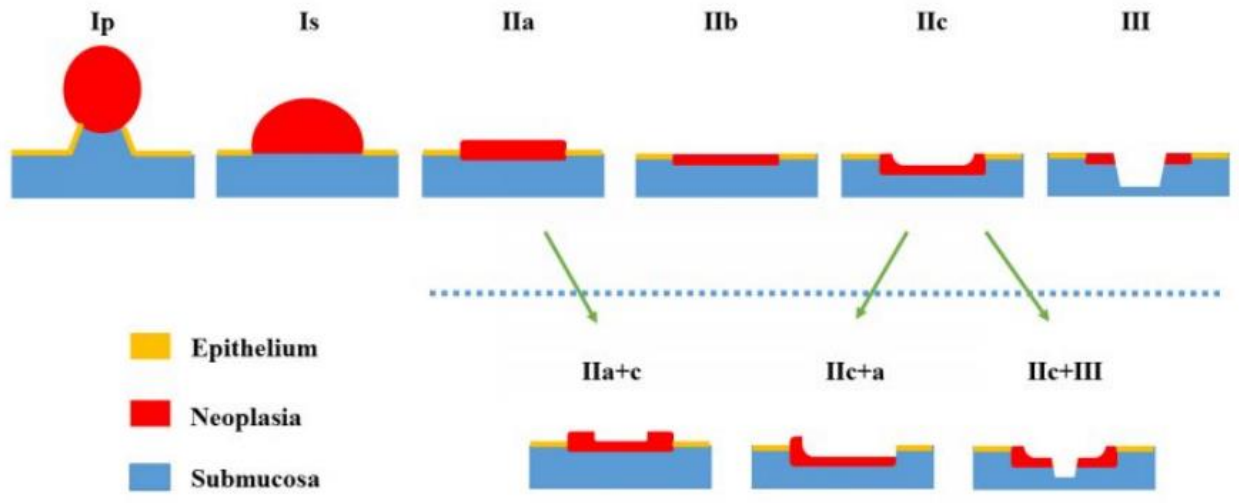

Figure 3. Paris classification (4).
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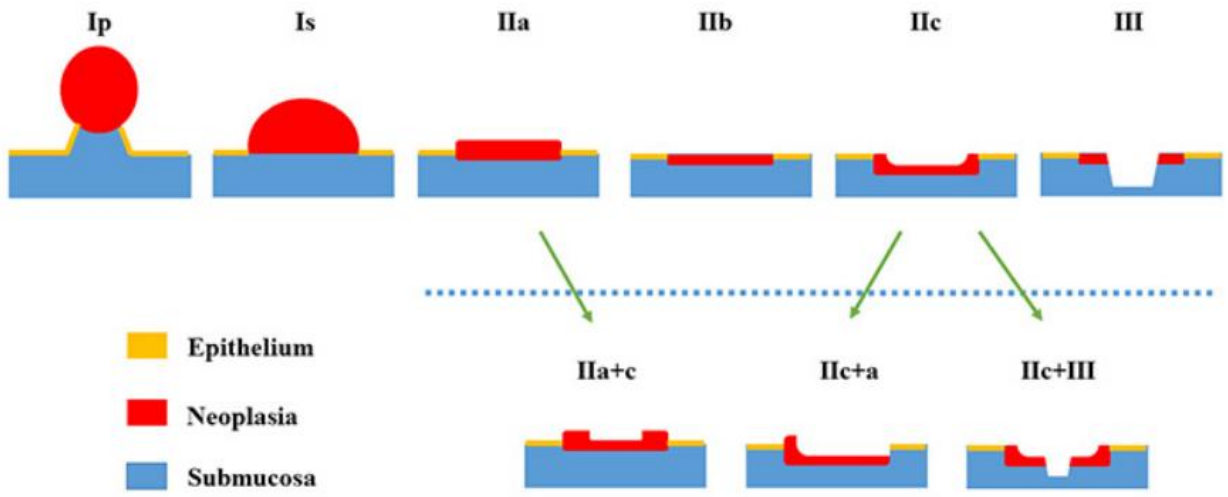

Figure 4. LSL classification based on surface appearance of the lesion (7).
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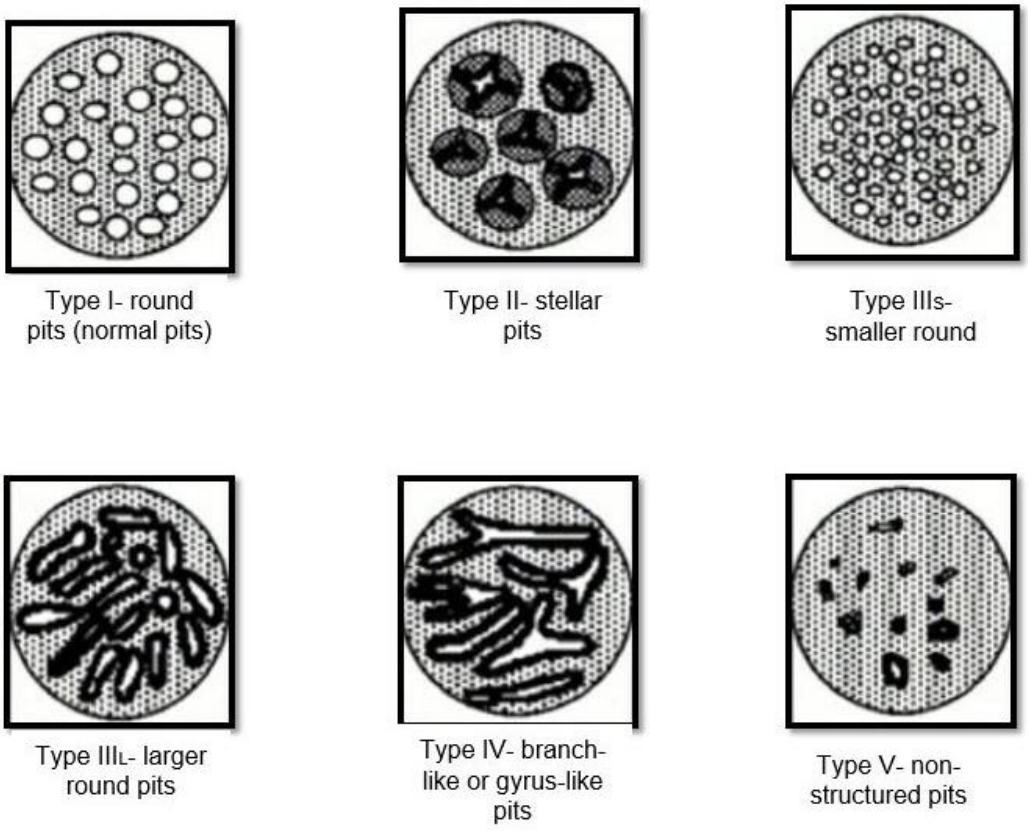

Figure 5. Kudo pit pattern classification for the surface appearance of polyps (9)

As can be seen (Figure 5) (9), Kudo's pit pattern classification uses configuration of pits as a guide to distinguishing neoplastic and non-neoplastic polyps. Type I pits are round; Type II pits are stellar; Type III pits are round but smaller (III-s) or larger (III-L) than type I pits. Branch-like or gyrus-like pits belong to the type IV group and non-structured ones fall in the type V group. In the pit pattern classification, types III, IV, and V are suspicious of malignant changes in contrast to types I and II, which are considered benign (they are commonly hyperplastic) (10, 11).

Figure 6 (12) delineates NICE classification, which

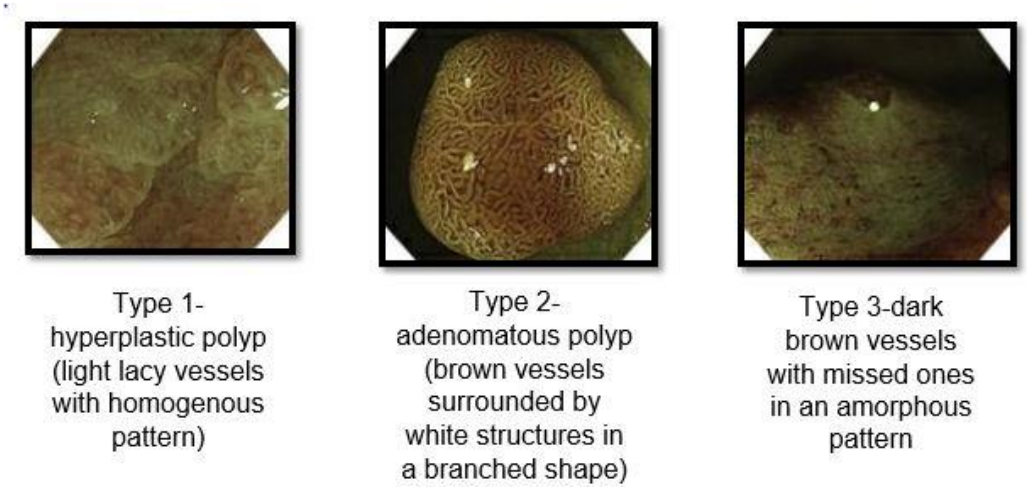

Figure 6. NICE classification (12)

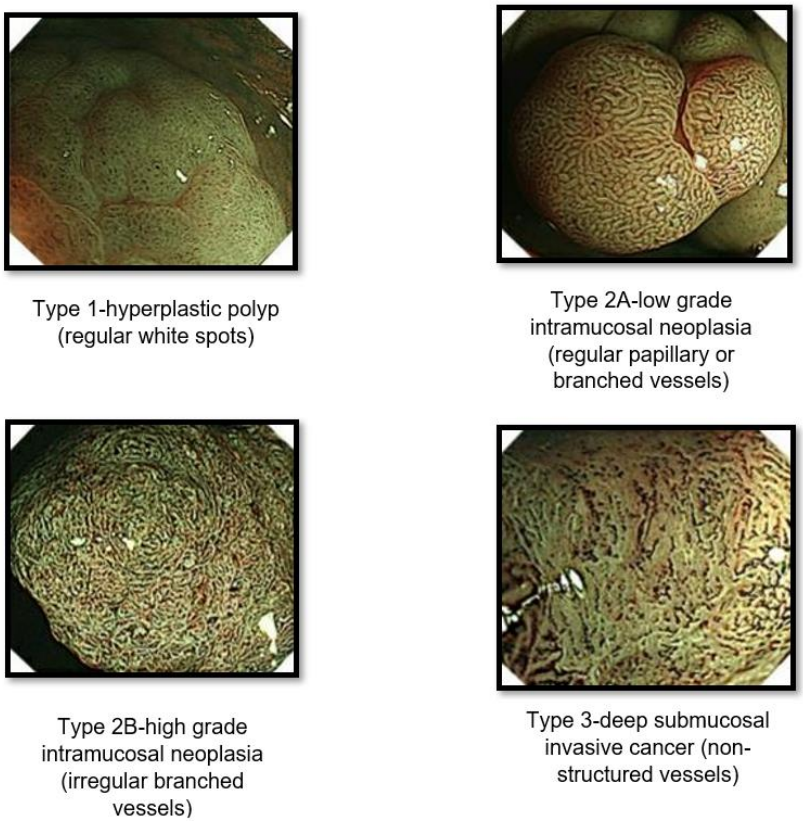

Figure 7. JNET classification for surface pattern of polyps (15)

uses optical chromoendoscopy to differentiate between hyperplastic polyps, adenomas and submucosal invasion by color, vascular structure, and surface pattern of polyps. Based on this classification, hyperplastic polyps (Type 1) are applied to the light-colored polyps with isolated fine vessels and uniform spots. Type 2 polyps are darker relative to the neighboring surface with regular or irregular structures of the epithelial pits surrounded by brown vessels indicating adenomas. Type 3 lesions resemble dark polyps with disrupted or missed vessels as well as unstructured pit patterns, raising the suspicion of an invasive carcinoma (13, 14). As depicted in Figure 7, JNET classification is comparable to NICE classification into two categories dependent on regular (2A) or irregular (2B) pits and vessels (16). Variable malignant potential of LSLs is measured by the depth of submucosal invasion which is generally seen in non-granular lesions more than in granular lesions. Specifically, pseudodepression in non-granular types and dominant nodules in granular types put LSLs at a greater risk for submucosal invasion (17).

Optical chromoendoscopy of the sigmoid polyp using high definition scope revealed a large pedunculated polyp with brown surface and epithelial pits surrounded by irregular vasculature, indicating an adenomatous polyp. The large stalk of the polyp drove the need for inserting a prophylactic hemoclip to prevent the probable vessel in the stalk from bleeding. The prophylactic hemoclip was inserted (Figure 8), diluted (1/10,0000) epinephrine was injected, and hot snare polypectomy was performed. The resected polyp was sent for pathological evaluation. The residual stalk of the polyp was examined which revealed scar of electrocautery without any bleeding or any sign of perforation.

Granular appearance of the second lesion made us proceed with an endoscopic resection. However, the management of these wide superficial and sometimes circumferential lesions is still challenging.

Based on the literature, endoscopic mucosal resection (EMR) is the procedure of choice for LSLs. En-bloc resection is usually achievable for LSLs measuring 10 to 20 mm. En-bloc resection of LSLs larger than 20 mm may not be feasible. According to the revised guidelines, piecemeal resection of such lesions is also accepted though the concern for local recurrence still remains. Thermal ablative methods such as argon plasma coagulation (APC) should be avoided because of high rates of recurrence. If well equipped, endoscopic submucosal dissection (ESD) will be the gold standard of removal of larger lesions even with a limited submucosal invasion (17, 18).

To remove the granular LSL of the case in question, 3-5 cc saline was injected. A relatively poor lifting sign with appearance of an outward blue bulla adjacent to the polyp was detected after injection. Thus, the question still remains whether the mentioned lesion would be endoscopically resectable or not at the sight of dominant nodules in the lesion and presence of non-lifting sign.

There are some classifications pointing at the depth

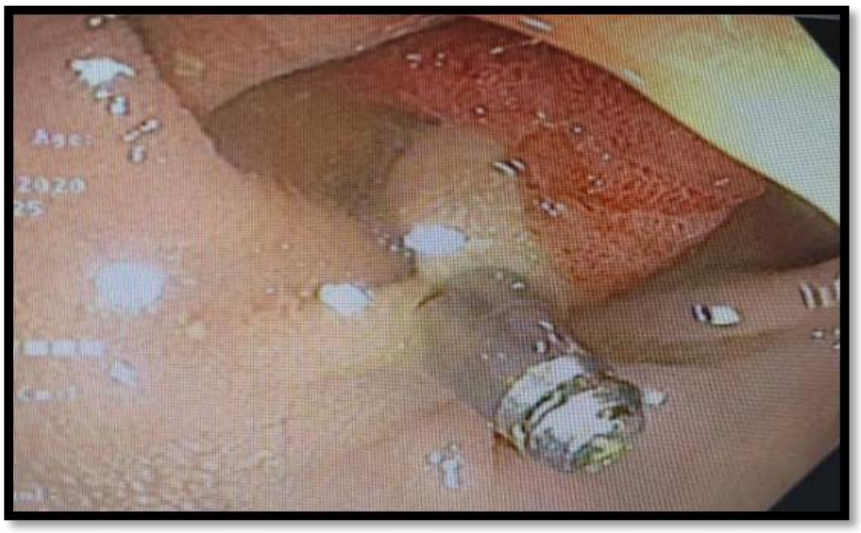

Figure 8. Prophylactic clip insertion before polypectomy

of invasion for flat or polypoid lesions such as Haggitt (19) and Kikuchi (20) classifications. It is suggested that deep submucosal invasion (Sm3) be resected surgically due to the risk of lymphovascular invasion and local recurrence. One practical technique used for differentiating deep submucosal invasion (Sm3) from mucosal or superficial submucosal invasion (Sm1-2) is saline injection prior to polypectomy and observation of the lesion if it is lifted or not. In contrast, non-lifting sign is indicative of a deep submucosal invasion requiring a surgical resection (21, 22). Of note, some exceptions (false negatives which are not contraindication for endoscopic resection) should be taken into account. Intramucosal injection arising from poor needle position is recognized by poor lifting sign as well as blue bleb formation near the lesion. It would be corrected by repositioning of the needle. Above that, there is submucosal fibrosis rooting from pervious biopsies and injections which prevent from a complete lifting sign. In such cases, a jet of fluid (jet sign) during the injection or elevation of the surrounding tissue instead of lesion elevation (canyon effect) might be detected. These circumstances do not definitely exclude the possibility of endoscopic resection (18).

Formation of a peripheral blue-gray bulla near the lesion after injection in the presented case made us suspicious of intramucosal injection. Repositioning of the needle and reinjection of the saline finally resulted in an acceptable lifting sign. Piecemeal EMR was performed using hot snare polypectomy. The specimens were sent for pathological evaluation.

Case 2

We were asked to consult on a 67-year-old man presented to the hospital with rectorrhagia and passage of maroon stool since 2 hours before arrival. His spouse denied any comorbidity or previous drug history. On admission, he was found to be confused with orthostatic hypotension. He was initiated on IV fluid. His past medical documents were remarkable for a recent polypectomy 10 days ago. His medical records revealed an EMR for an approximately 12 mm sessile polyp in the descending colon. His clinical scenario, suggestive of a lower GI bleeding leading to an unstable hemodynamic status, made us proceed with an urgent upper endoscopy once he became hemodynamically stable. However, upper endoscopy was unremarkable. So, was performed. Bleeding was detected in the left colon not spreading proximally through the splenic flexure. What is the most probable diagnosis in this situation and the best management for?

Colonic polypectomy complication rates are not high. EMR and ESD as therapeutic endoscopic procedures especially in the right colon and for larger polyps pose a substantial risk for complications (23). Indeed, bleeding as the most common complication of polypectomy would be intra-procedural or delayed. Colonic polypectomy bleeding is estimated to be about 10% for intra-procedural bleeding as well as 2-7% for delayed bleeding according to the literature (24). Hemostasis for intra-procedural bleeding is usually achieved spontaneously or via endoscopic interventions such as snare tip soft coagulation (STSC) and coagulation forceps. Clip insertion is also applicable but is rarely required (25). The superiority of the soft coagulation technique to the previous techniques such as forced coagulation is explained by the fixed peak voltage in the novel technique, which is obtainable by a rapid tissue resistance increase once the desired coagulation is achieved. This fixed voltage allows the lower deep thermal injury in STSC technique versus forced coagulation technique (26). Delayed bleedings are considered to occur within 15 days after polypectomy (commonly in the first 48 hours after resection). Previous antiplatelet or anticoagulant consumption, larger polyps, older patients, and presence of comorbidities are known risk factors for delayed bleeding. More than half of the delayed bleedings are resolved spontaneously, but those resulting in severe bleeding and shock should be managed endoscopically. Prophylactic methods such as clip closure of the defect or non-bleeding visible vessels as well as coagulation techniques for pedunculated or sessile polyps have been a point of challenge for years due to the high cost of the techniques and inconclusive results among different studies. Among the prophylactic techniques, clip closure for the larger stalks of pedunculated polyps alone or in combination with diluted epinephrine injection has been proposed to reduce the percentage of post-polypectomy bleeding and is recommended routinely (27).

The clinical picture of the presented case was indicative of a probable delayed post-polypectomy bleeding. Attempts were made to find the location of bleeding and establish an endoscopic hemostasis. A visible vessel was found in the

site of resection. Hemostasis was successfully achieved by inserting a hemoclip.

Case 3

A 42-year-old man with a positive family history of CRC was suggested for a total colonoscopy. Total colonoscopy was completed with an excellent preparation. A large sessile polyp was detected in the cecum which was removed by hot snare after submucosal injection of methylene blue. The area of polypectomy was examined to determine if there is perforation or bleeding, which was consistent with type 1 deep mucosal injury, based on Sydney classification. The patient was stable in the recovery room, so discharged since he continued to remain stable. Eight hours post-polypectomy, he presented to the hospital with a severe diffuse abdominal pain initiating some hours after polypectomy. On admission, his vital signs were stable. Then, he spiked a temperature of 38oc. His physical examination was remarkable for a moderate to severe right lower quadrant tenderness without rebound tenderness. His laboratory data were remarkable only for a mild leukocytosis and an elevated CRP level. An abdominopelvic CT scan was demanded due to suspicion of a probable perforation which revealed. What are the diagnosis and the best management for?

One of the most serious complications of colonoscopy coupled with polypectomy is perforation of the colonic wall, which is seen in 1-5% of therapeutic colonoscopies (27). The clinical signs and symptoms of free colonic wall perforations (abdominal pain and tenderness) are attributed to local peritonitis. Observation of contrast leakage or free abdominal air on imaging is indicative of colonic wall perforation which requires an urgent surgical management. Although conservative managements are, but they are confined to the patients with limited perforations and excellent general condition. So, non-surgical managements are not routinely advisable in case of peritonitis (28). Polypectomy of larger polyps and sessile polyps, polypectomy at rectosigmoid junction, polypectomy in case of colonic obstruction, as well as previous history of abdominal surgery are risk factors for iatrogenic perforation (29). A complete submucosal injection before EMR would properly separate the lesion from submucosa, allowing the lesion to be resected without submucosal damage, bleeding, and perforation. It also lowers the risk of thermal injury during hot snare polypectomies using electrocautery. Dye injection (indigo carmine or methylene blue) helps distinguish submucosal layer boundary from muscularis propria (30). Deep mural injury (DMI) after EMR of LSLs > 2cm has been classified by Sydney classification into six categories as depicted in Figure 9.

Type 0 DMI reveals the blue-painted submucosal layer with obliquely located white fibers of connective tissue and undamaged vessels consistent with a perfect mucosal resection. Type 1 DMI indicates a complete submucosal resection, which is identified by colorless layer of muscularis propria filled with circular muscle fibers. This schema is called whale sign. Type 2 DMI raises suspicion of muscularis propria injury though it is not definitely proved. Previous manipulation of the lesion and its resultant fibrosis as well as incomplete submucosal injection of the lesion are the reasons why submucosa is not distinctly differentiated from muscularis propria in type 2 DMI. Type 3 DMI definitely supports the muscularis propria injury by presence of a target sign in the resection site or a specimen sign in the resected lesion. Clip closure of the target sign has been recommended. Type 4 DMI clearly resembles perforation. Clip insertion would preclude an inevitable surgery. It is recommended that the lesion be resected completely before clip insertion due to future submucosal fibrosis, which prevents from subsequent complete resection of the lesion. Type 5 DMI shows a full thickness perforation which is contaminated by feces. Endoscopic closure of defect is considered, though surgical consultation is required too (31).

It is crucial to take other differential diagnoses into account as well. Severe abdominal pain, leukocytosis, and fever attributed to post-polypectomy electrocoagulation syndrome. Thus, the point is to suspect a diagnosis of post-polypectomy electrocoagulation syndrome as a differential diagnosis of abdominal pain after polypectomy especially when an electrocautery snare polypectomy has been utilized. This syndrome is characterized by local peritonitis due to transmural passage of electrical current used for electrocoagulation during polypectomy (32). The incidence of post-polypectomy syndrome is reported to be approximately 1% in different studies. To exclude a free bowel wall perforation, abdominopelvic CT scan (with/without) (IV/oral) contrast is recommended (33).

Larger polyps (>2cm), right-sided polypectomy where the bowel wall is thinner, flat (nonpolypoidal) lesions, hypertension, and other comorbidities such as atherosclerosis have been introduced to be the major risk factors for postpolypectomy syndrome (34).

The presented case was admitted to hospital and was kept NPO. Then, he started on IV fluids, broad spectrum antibiotics, analgesics, and close monitoring of vital signs. Patient's gradual amelioration during a 24-hour conservative management. His resection site findings consistent with type 1 DMI Sydney classification also corroborated the diagnosis of post-polypectomy electrocoagulation syndrome. Finally, the patient was discharged once improved via conservative approach.

Case 4

A 63-year-old woman with a history of piecemeal resection of a 35-mm sessile polyp in the transverse colon since 7 months ago was referred to the office for further follow-up. She denied any other past medical history. Her family history was also negative for CRC. Total colonoscopy had been completed in an excellent preparation. Given the risk of relapse after piecemeal EMR, what is your recommendation for surveillance of this patient?

Although endoscopic piecemeal mucosal resection is accepted as an effective procedure for large sessile and flat colorectal lesions, but it is still on debate because of high rates of local recurrence. Studies have estimated that local recurrence after EMR would be approximately 3% up to 20% for en-bloc and piecemeal resections, respectively (35). Thus, it is recommended that a repeat examination for scar of polypectomy be conducted within 3-6 months from index colonoscopy to determine if complete resection of the lesion has been performed. Colonoscopic examination of the site of resection has emerged as an important management strategy in early detection and endoscopic resection of residual tissue plus local tumor recurrence (36). The probability of missed synchronous or metachronous lesions is also amenable to a routine surveillance after EMR. Incomplete versus complete resection of adenomas or neoplastic lesions, larger (>2cm) versus smaller polyps, piecemeal versus en-bloc resection, adenomatous versus serrated polyps, and high-grade versus low-grade dysplasia are well-known risk factors for local recurrence (37). Although ESD and en-bloc resection are more efficacious than piecemeal EMR in complete resection of the lesions, they are not preferred over EMR due to the lack of experience in the vast majority of centers and their time-consuming characteristic. It is widely accepted that surveillances be performed by high-definition white light endoscopy using NBI mode since standard definition endoscopies suffer from a relatively poor sensitivity in detection of local recurrence. Despite the accurate endoscopic assessment of the site, biopsies are recommended to be obtained from suspicious lesions for a precise histologic evaluation. The next colonoscopy is followed and carried out 12 months after polypectomy. Then, next colonoscopies would be scheduled based on CRC screening programs (38). Surveillance colonoscopy after en-bloc resection of the lesions is considered 12 months after the index procedure and then is followed based on the CRC screening programs. Normal scar of polypectomy is more pallid than surrounding epithelium and an anatomical distortion in the site of polypectomy is predictable due to the convergence of the folds. Inflammatory nodules and clip artifacts

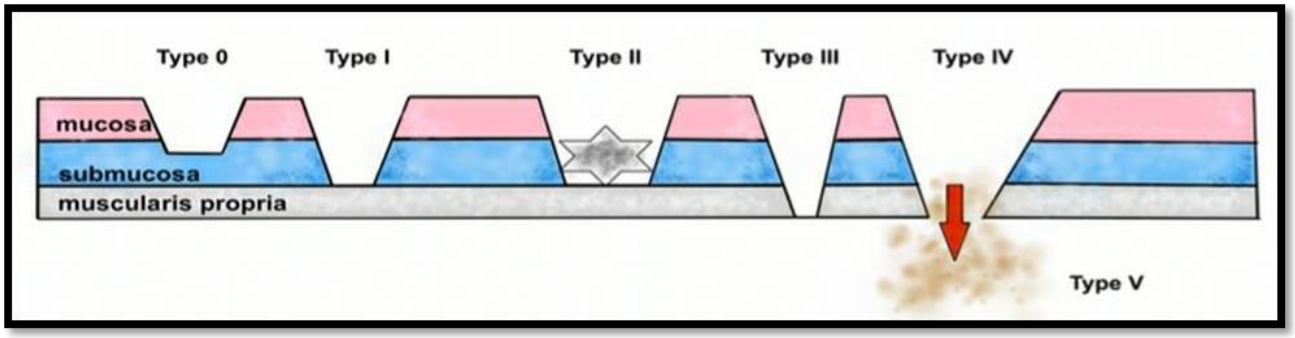

Figure 9. Sydney classification for deep mural injury (31)
Source: https://www.endoscopy-campus.com/

which are hyperplastic nodules without any optical neoplastic features are not considered neoplastic and should be differentiated from recurrence of the lesion which shows an adenomatous pattern in NBI view. Recurrent or residual tissues after EMR are endoscopically resectable. An appropriate approach to the local recurrence after ESD might be different, which is beyond the scope of this study.

It seems that the presented case has lost to follow up until this visit. As such, she was recommended to undergo a surveillance colonoscopy as soon as possible.

Conflict of interests

The authors declare that they have no conflict of interest.

References

1. Rafiemanesh H, Pakzad R, Abedi M, Kor Y, Moludi J, Towhidi F, et al. Colorectal cancer in Iran: epidemiology and morphology trends. EXCLI J 2016;15:738-44.

2. Meseeha M, Attia M, eds. Colon polyps. Treasure Island (FL): StatPearls Publishing; 2021.

3. The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach and colon. Gastroint Endosc 2003;58:3-43.

4. Gupta S. Trouble in Paris classification: polyp morphology is in the eye of the beholder. Am J Gastroenterol 2015;110:188-91.

5. Oka S, Tanaka S, Kanao H, Oba S, Chayama K. Therapeutic strategy for colorectal laterally spreading tumor. Dig Endosc 2009;21:43-46.

6. Yamada M, Saito Y, Sakamoto T, Nakajima T, Kushima R, Parra-Blanco A, et al. Endoscopic predictors of deep submucosal invasion in colorectal laterally spreading tumors. Endoscopy 2016;48:456-64.

7. Meier B, Caca K, Fischer A, Schmidt A. Endoscopic management of colorectal adenomas. Ann Gastroenterol 2017;30:592-7.

8. Hayashi N, Tanaka S, Hewett DG, Kaltenbach TR, Sano Y, Ponchon T, et al. Endoscopic prediction of deep submucosal invasive carcinoma: validation of the narrow-band imaging international colorectal endoscopic (NICE) classification. Gastrointest Endosc 2013;78:625-32.

9. Kudo S, Tamura S, Nakajima T, Yamano H, Kusaka H, Watanabe H. Diagnosis of colorectal tumorous lesions by magnifying endoscopy. Gastrointest Endosc 1996;44:8–14.

10. Li M, Ali SM, Gilani SUO, Liu J, Li YQ, Zuo XL. Kudo's pit pattern classification for colorectal neoplasms: a meta-analysis. World J Gastroenterol 2014;20:12649-56.

11. Tung SY, Wu Cs, Su MY. Magnifying colonoscopy in differentiating neoplastic from nonneoplastic colorectal lesions. Am J Gastroenterol 2001;96:2628-32.

12. Hayashi N, Tanaka S, Hewett DG, Saunders BP, Rex DK, Soetikno RM. Endoscopoc prediction of deep submucosal invasive carcinoma: validation of the NICE classification. Gastrointest Endosc 2013;78:625-32.

13. Patrun J,Okresa L, Ivekovic H and Rustemovic N. Diagnostic accuracy of NICE classification system for optical recognition of predictive morphology of colorectal polyps. Gastroenterol Res Pract 2018;2018:7531368.

14. Hewett DG, Kaltenbach T, Sano Y, Tanaka S, Saunders BP, Ponchon T, et al. Validation of a simple classification system for endoscopic diagnosis of small colorectal polyps using narrow-band imaging. Gastroenterology 2012;143:599-607.

15. Okamoto Y, Oka S, Tanaka S, Kamigaichi Y, Tamari H, Shimohara H, et al. Effect of educational lecture on the diagnostic accuracy of Japan NBI Expert Team classification for colorectal lesions. BMC Gastroenterol 2021;21:110.

16. Kobayashi S, Yamada M, Takamaru H, Sakamoto T, Matsuda T, Sekine S, et al. United Eur Gastroent J 2019;7:914-23.

17. Li DH, Liu XY, Huang C, Deng CN, Zhang JL, Xu XW et al. Pathological analysis and endoscopic characteristics of colorectal laterally spreading tumors. Cancer Manag Res 2021;13:1137-44.

18. Ferlitsch M, Moss A, Hassan C, Bhandari P, Dumonceau JM, Papatis G, et al. Colorectal polypectomy and endoscopic mucosal resection (EMR): European Society of Gastrointestinal Endoscopy (ESGE) clinical guideline. Endoscopy 2017;49:270-297.

19. Ramirez M, Schierling S, Papaconstantinou HT, Thomas JS. Management of the malignant polyp. Clin Colon Rectal Surg 2008;21:286-290.

20. Neilson LJ, Rutter MD, Saunders BP, Plumb A, Rees CJ. Frontline Gastroenterol 2015;6:117-126.

21. Friedland S, Shelton A, Kothari S, Kochar R, Chen A, Benerjee S. Endoscopic Management of nonlifting colon polyps. Diagn Ther Endosc 2013;2013:412936

22. Russo P, Barbeiro S, Awadie H, Libanio D, Dinis-Ribeiro M, Bourke M. Management of colorectal laterally spreading tumors: a systematic review and meta-analysis. Endosc Int Open 2019;7:239-59.

23. Choo WK, Subhani J. Complication rates of colonic polypectomy in relation to polyp characteristics and techniques: a district hospital experience. J Interv Gastroenterol 2012;2:8-11.

24. Amato A, Radaelli F, Correale L, Giulio ED, Buda A, Cennamo V, et al. Intra-procedural and delayed bleeding after resection of large colorectal lesions: the SCALP study. United European Gastroenterol J 2019;7:1361-72.

25. Fahrtash-Bahin F, Holt BA, Jayasekeran V, Sonson R, Lee EY, Williams SJ, et al. Tu1499 snare tip soft coagulation technique for hemostasis of intraprocedural bleeding during wide field endoscopic mucosal resection of large colonic lesions. Gastrointest Endosc 2013;77:562-3.

26. Mack A, Mangira D, Moss A. Prevention of delayed post-polypectomy bleeding: should we amend the 2017 ESGE guideline? Endosc Int Open 2020;8:1111-14.

27. Luning TH, Keemers-Gels ME, Barendregt WB, Tan AC, Rosman C. Colonoscopic perforations: a review of 30366 patients. Surg Endosc. 2007; 21: 994-997.

28. Avgerinos DV, Llaguna OH, Lo AY, Leitman IM. Evolving management of colonoscopic perforations. J Gastrointest Surg 2008;12:1783-9.

29. Hormati A, Ghadir MR, Alavinejad P, Sarkeshikian SS, Pezeshki Modares M. Repair of polypectomy colonic perforation by endoclip: a case report. J Coloproctol (Rio J) 2013;35:227-9.

30. Castro R, Libanio D, Pita I, Dinis Ribeiro M. Solutions for submucosal injection: What to choose and how to do it. World J Gastroenterol 2019;25:777-8.

31. Burgess NG, Bassan MS, McLeod D, Williams SJ, Byth K, Bourke MJ. Deep mural injury and perforation after colonic endoscopic mucosal resection: a new classification and analysis of risk factors. Gut 2017;66:1779-89.

32. Kim HW. What is different between postpolypectomy fever and postpolypectomy coagulation syndrome? Clin Endosc 2014;47:205-6.

33. Benson BC, Myers JJ, Laczek JT. Postpolypectomy electrocoagulation syndrome: A mimicker of colonic perforation. Case Rep Emerg Med 2013;2013:687931.

34. Jehangir A, Bennett KM, Rettew AC, Fadahunsi O, Shaikh B, Donato A. Post-polypectomy electrocoagulation syndrome: a rare cause of acute abdominal pain. J Community Hosp Intern Med Perspect 2015;5:29147.

35. Belderbos TD, Leenders M, Moons LM, Siersema PD. Local recurrence after endoscopic mucosal resection of nonpedunculated colorectal lesions: systematic review and meta-analysis. Endoscopy 2014;46:388-402.

36. Tanaka S, Kashida H, Saito Y, Yahagi N, Yamano H, Saito S, et al. JGES guidelines for colorectal endoscopic submucosal dissection/endoscopic mucosal resection. Dig Endosc 2015;27:417-34.

37. Shichijo S, Takeuchi Y, Uedo N, Ishihara R. Management of local recurrence after endoscopic resection of neoplastic colonic polyps. World J Gastrointest Endosc 2018;10:378-82.

38. Seo GJ, Sohn DK, Han KS, Hong CW, Kim BC, Park JW, et al. Recurrence after endoscopic piecemeal mucosal resection for large sessile colorectal polyps. World J Gastroenterol 2010;16:2806-11.