NARROW BAND IMAGING VERSUS CHROMOENDOSCOPY AND CONVENTIONAL COLONOSCOPY IN DETECTION OF DIFFERENT COLONIC LESIONS

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ABSTRACT

Background: Narrow band imaging (NBI) is a new technique that uses optical filters for imaging of mucosal morphology. Thus, it can identify colonic polyp/mass through pit pattern and vascular pattern.

Objective: To evaluate the efficacy of NBI in comparison with chromo endoscopy and conventional colonoscopy for detection of colorectal lesions.

Patients and Methods: This study was carried out at Hepatology, Gastroenterology and Infectious diseases Department, Al-Hussein University Hospital. The study population included 200 patients from April 2019 to November 2020.By colonoscopy, 37 patients were excluded that had internal hemorrhoids, colonic diverticula, colonic ulcers or no abnormal colonoscopy finding. The rest 163 patients had colonic polyp/masses were divided into two groups. Group I included 102 patients who had colonic polyps, and Group II included 61 patients with colonic masses. The two groups underwent NBI (using NICE classification), chromo endoscopy (using Kudo classification), and biopsies were taken for histopathology.

Results: There was a statistically significant relation between histopathological characters of the polyps/masses and their characters by NBI /chromo endoscopy (P < 0.001). NBI /chromo endoscopy can detect adenocarcinoma with 100% sensitivity and 94.7% specificity. Sensitivity and specificity for hyperplastic polyp was 93.5% and 91.5% respectively. Adenoma was 90.9% and 89.4% respectively. Sensitivity and specificity for malignant masses was 100% and 60%respectively.

Conclusion: NBI can detect either colorectal polyp or mass, and predict its histology more rapid and simple than chromo endoscopy which needed stains and time consuming. Thus, can reduce the cost of the health system and the risk of polypectomy.

Keywords: Colonic polyp/ mass, narrow band imaging, Chromo endoscopy.

INTRODUCTION

Narrow-band imaging (NBI) is one of the methods of optical chromo endoscopy that uses high resolution colonoscopy to give a detailed description of the surface tissue of the neoplasm and its vascular pattern, and thus characterizes the polyps while performing endoscopy so-called virtual biopsy, which would be equal to

the histological feature *(Patrun et al., 2018)*.

NBI system is based on the properties of the hemoglobin as the major tissue chromophore. The peak absorption of oxyhemoglobin is at 415 nm (blue light). A secondary peak of absorption is at 540 nm (green light). NBI technique uses a special filter placed in the light source that allows only narrow band of blue and green light to pass through *(Vişovan et al., 2017)*.

The NBI International Colorectal Endoscopic (NICE) Classification applicable for non-magnified NBI imaging, have been validated by a group of international experts in order to characterize colonic polyps and uses mucosal color, vessel and surface pattern to differentiate between hyperplastic polyps ,adenoma and invasive carcinomas *(Utsumi et al., 2015)*.

Chromo endoscopy involves topical application of stains such as indigo carmine where on application they seep between grooves and crevices providing overall details of the contour of the mucosal surface. Thus, aids the endoscopist in highlighting and characterizing lesions in the GIT during endoscopy through pit pattern (Kudo classification) *(Kheir et al., 2016)*. Type I round pit reveal normal mucosa. Type II stellar or asteroid pit reveal hyperplastic, sessile serrated adenoma/ polyp. Type IIIS small rounded or tubular pits reveal adenoma with low grade dysplasia. Type IIIL large rounded or tubular pits reveal adenoma with low grade dysplasia. Type IV branch like or gyrus like pits reveal adenoma with high grade dysplasia. Type

V non-structured or irregular pits reveals malignant *(Carlo et al., 2014)*.

This study aimed to evaluate the efficacy of narrow band imaging in comparison with chromo endoscopy and conventional colonoscopy for detection of colorectal lesions.

PATIENTS AND METHODS

This study had been accomplished at Al-Azhar University Hospitals, Hepatology, Gastroenterology and Infectious diseases Departments in Cairo, at the period from April 2019 till November 2020. The study protocol adopted was approved by the Medical Ethics Committee; Al-Azhar Faculty of Medicine .All patients gave written informed consents. Study enrolled 200 patients which had the following inclusion criteria (rectal bleeding, chronic abdominal pain or discomfort, chronic constipation, family history of colorectal carcinoma, patients who had past history of colorectal tumor resection, past history of polypectomy or fecal occult blood in stool is positive). Exclusion criteria included pregnancy, patients who had intestinal obstruction or IBD.

Patients subjected to the following: History of (Abdominal pain, change in bowel habits, rectal bleeding, weight loss, chronic constipation, family history of CRC and past history of polypectomy), General, local examinations and laboratory investigations (CBC, ESR, CRP, CEA and occult blood in stool), Colonoscopy procedure: Well preparation of bowel was done then examined by:

I.   White light colonoscopy revealed 163 patients had colonic polyps /masses then categorized into two groups:

Group 1: Patients with colonic polyps and **Group 2:** Patients with colorectal masses.

II. NBI colonoscopy: The Olympus 290 series endoscopy system (EVIS LUCERA ELITE), NICE classification was used.

III. Chromo endoscopy: Indigo carmine stain (0.4%) was sprayed directly onto the mucosa. Kudo classification was used and histopathological examination for the biopsies taken.

Statistical analysis: Data were expressed using SPSS software package version 20.0 and described using mean± standard deviation. The Chi square test was used to assess statistical significance of mean difference between the studied groups. The probability level of $P<0.05$ was set for statistical significance.

RESULTS

By colonoscopy, out of 200 patients had included in this study; 102 patients had colonic polyps, 61 patients had colonic masses and the rest of patients had different colonic lesions (13 patients had internal hemorrhoids, 5 patients had colonic diverticula, 4 patients had colonic ulcers with picture suggestive of inflammatory bowel disease (IBD) and 15 patients had no abnormal colonoscopy finding) **(Table 1)**.

Table (1):   Lesions detected among the studied cases by colonscopy(n = 200)

Colonic lesion	Number of cases	%
Polyp	102	51.0
Mass	61	30.5
Other		
Internal haemorrhoids only	13	6.5
Colonic diverticulae only	5	2.5
Colonic ulcers with picture suggestive of IBD	4	2
No abnormal colonoscopic finding	15	7.5

The characteristics of the polyps / masses detected using NBI according to NICE classification and chromo endoscopy according to Kudo's classification showed that: out of 102 patients with polyps; 55 patients had adenomatous polyps, 35 patients had hyperplastic polyps and 12 patients had malignant polyps. While out of 61 patients with masses; 3 patients were adenoma and 58 patients were malignant. Histological characteristics of the polyps were as the following: Adenoma accounted for 55patients distributed as 31cases were tubular adenoma, 9 cases were tubulovillous adenoma, 6 cases were traditional serrated adenoma ,2 cases were TSA with high grade dysplasia , 5 cases were sessile serrated adenoma , 1 case was tubulovillous adenoma with high grade dysplasia , 1 case was villous adenoma. Hyperplastic polyps accounted for 31 cases, inflammatory polyps accounted for 9 cases. Adenocarcinoma accounted for 7 cases .While histological characteristics of the masses were as the following: Adenocarcinoma accounted for 56patients, 4 cases high grade dysplasia (HGD) and one case low grade dysplasia (LGD) **(Table 2 & Figure 1)**.

Table(2): **Distribution of cases with colonic polyps/massesusing NBI/ chromoendoscopy and Histopathology (n = 163)**

| Parameters / Colonic lesions	NBI/ chromoendoscopy	No.	%	Histopathology	No.	%
Polyps	Adenoma	55	33.74	Adenoma	55	33.74
	Hyperplastic	35	21.47	Tubular adenoma	31	19.02
	Malignant	12	7.36	Tubulovillous adenoma	9	5.52
				Traditional Serrated Adenoma(TSA)	6	3.68
				Sessile Serrated Adenoma	5	3.07
				TSA with high grade dysplasia	2	1.23
				Tubulovillous adenoma with high grade dysplasia	1	0.61
				Villous adenoma	1	0.61
				Hyperplastic	31	19.02
				Inflammatory	9	5.52
				Adenocarcinoma	7	4.29
Masses	Adenoma	3	1.84	Adenocarcinoma	56	34.36
	Malignant	58	35.58	High grade dysplasia	4	2.45
				Low grade dysplasia	1	0.61
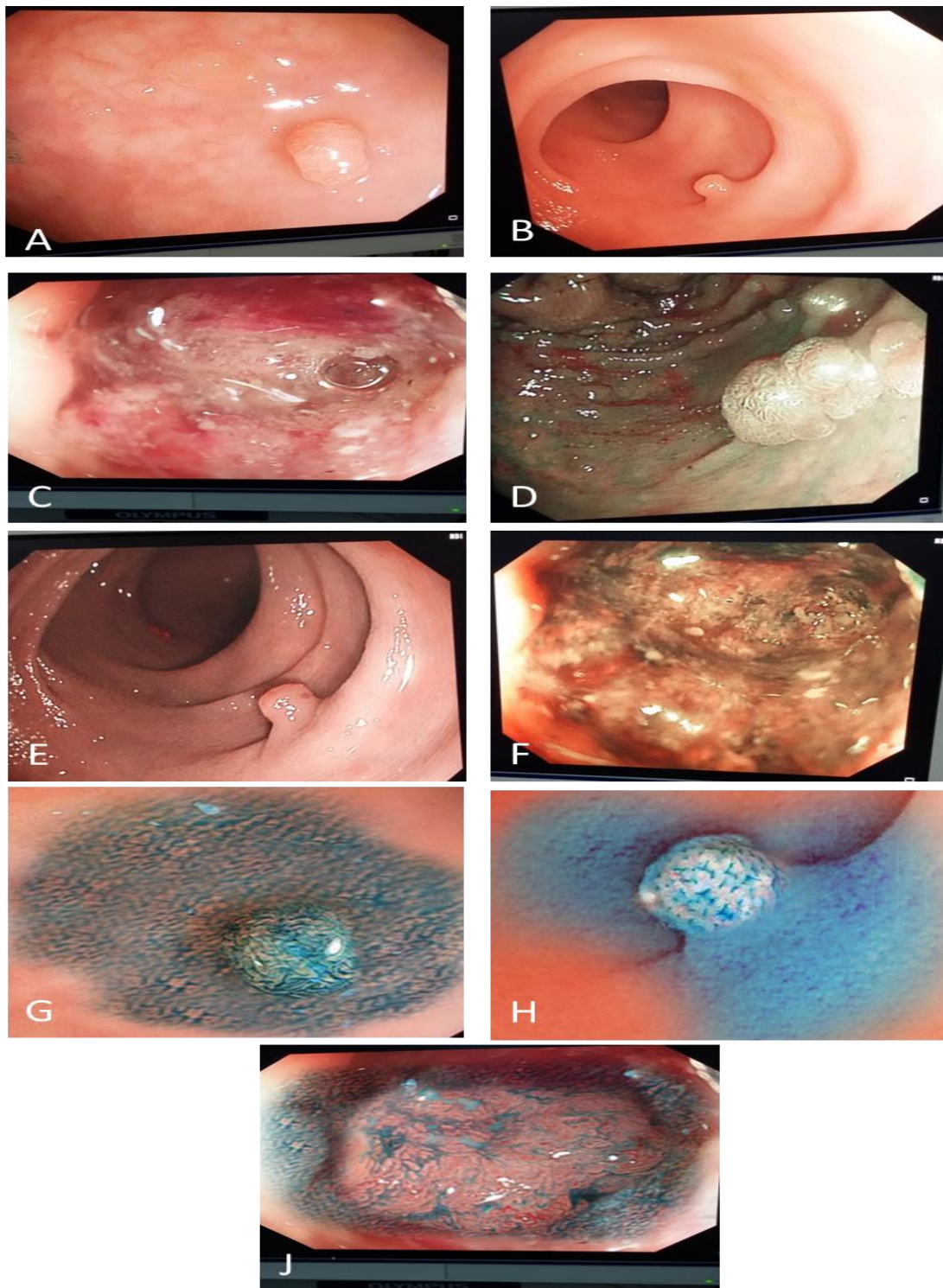
Figure (1): White-light colonoscopy, NBI and chromoendoscopy of colonic polyps and masses. A: sessile polyp at ascending colon by white-light colonoscopy. B: pedunculated polyp at transverse colon by white-light colonoscopy. C: mass at descending colon by white-light colonoscopy. D: adenomatous polyp by NBI. E: hyperplastic polyp by NBI. F: malignant mass by NBI. G: adenomatous polyp by chromoendoscopy. H: hyperplastic polyp by chromoendoscopy. J: malignant mass by chromoendoscopy

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There was a statistically significant relation between histopathological characters of the polyps/masses and their characters by NBI /chromo endoscopy **(Table 3)**.

Table (3): Relation between histopathology finding of colonic polyps/masses and NBI/chromoendoscopy

Histopathology NBI/ Chromoendoscopy		Polyps								Masses					
		Adenocar-cinoma (n = 7)		Hyperplastic (n = 31)		Inflammatory (n = 9)		Adenoma (n = 55)		Adenocarc-inoma (n = 56)		HGD (n = 4)		LGD (n = 1)	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%
Polyp	Adenoma	0	0	2	6.5	3	33.3	50	90.9	0	0	0	0	0	0
	Hyperplastic	0	0	29	93.5	6	6.7	0	0	0	0	0	0	0	0
	Malignant	7	100	0	0	0	0	5	9.1	0	0	0	0	0	0
Mass	Adenoma	0	0	0	0	0	0	0	0	0	0	2	50	1	100
	Adenocarcinoma	0	0	0	0	0	0	0	0	56	100	2	50	0	0
^{MC}p		<0.001*													

Chi square test

NBI /chromo endoscopy can detect adenocarcinoma with 100% sensitivity and 94.7% specificity. Sensitivity and specificity for hyperplastic polyp was 93.5% and 91.5% respectively .While for adenoma was 90.9% and 89.4% respectively. Sensitivity and specificity for malignant mass was 100% and 60% respectively **(Table 4)**.

Table (4): Agreement (sensitivity, specificity and accuracy) for NBI/ chromoendoscopy to detect colonic polyps/masses (n =163)

Histopathology NBI/ Chromoendoscopy	-ve		+ve		Sensitivity	Specificity	PPV	NPV	Accuracy
	No.	%	No.	%					
Adenocarcinoma polyps									
-ve	90	94.7	0	0	100.0	94.7	58.3	100.0	95.1
+ve	5	5.3	7	100					
$\square^2$(p)	56.368*(<0.001*)								
Hyperplastic polyps									
-ve	65	91.5	2	6.5	93.5	91.5	82.9	97.0	92.2
+ve	6	8.5	29	93.5					
$\square^2$(p)	69.329* (<0.001*)								
Adenomatous polyps									
-ve	42	89.4	5	9.1	90.9	89.4	90.9	89.4	90.2
+ve	5	10.6	50	90.9					
$\square^2$(p)	65.723* (<0.001*)								
Adenocarcinoma masses									
-ve	3	60	0	0	100	60	96.6	100	96.7
+ve	2	40	56	100					
$\square^2$(p)	35.338* (<0.001*)								

$\chi 2$, p: $\chi 2$ and p values for Chi square test for comparing between the two groups.

DISCUSSION

This study was carried out on 200 patients admitted to endoscopy unit for different causes. The aim of this work was to assess the role of NBI colonoscopy for detection and differentiation of colorectal polyps and masses versus chromo endoscopy and conventional colonoscopy. The most common complaint was bleeding per rectum in 36% of our patients, bowel changes was the presenting symptom in 19%, abdominal pain in 21%, anemia in 25%, constipation in 7.5%, 3.5% had history of polypectomy and 3% with family history of CRC.

Vişovan et al. (2017) studied the role of narrow band imaging in colorectal polyps detection showed that the most common complaint was intestinal transit disorders 22.5%, and the second common was rectal bleeding 19.9%.

Because of the association of colonic polyps with CRC, detection and differentiation of the polyps are very important .Many methods can be used for detection of colorectal polyps as fecal occult blood testing, fecal DNA testing, CT enterocolonography and colonoscopy *(Garber et al., 2015)*. *Cellier et al. (2019)* verified the feasibility of examining the "pit patterns" of the colonic polyp to differentiate between these two polyps via magnified endoscopy and indigo carmine dye contrast.

The NBI system utilizes light in short, limited wavelengths that allow visualization of the hemoglobin absorption band, such as that indicative of blood vessels, with adequate contrast via a single touch of the control switch *(Utsumi et al., 2015)*.

In this study, the polyps were distributed according to its histopathological characteristics as the following 53.92% of patients had adenomatous polyp, 30.39% had hyperplastic polyps and 6.86% were malignant. And according to NBI using NICE classification or chromo endoscopy using Kudo classification into 53.92% had polyps adenomatous in nature, 34.31% had hyperplastic polyps and 11.76% were malignant. Thus statically significant relation between the histopatological characteristics and NBI/ chromo endoscopy features was proved (P < 0.001). The sensitivity for adenoma was 90.9%, specificity 89.4% and accuracy 90.2%.The sensitivity for hyperplastic polyps 93.5%, specificity 91.5% and accuracy 92.2%.The sensitivity for adenocarcinoma was 100%, specificity 94.7% and accuracy 95.1%.

Vişovan et al. (2017) studied the role of narrow band imaging in colorectal polyps detection. In NBI group, histopathologicaly, 66.15% adenomas, 32.62% hyperplastic polyps, and 1.23% carcinomas .The sensitivity and specificity of NBI technique combined with the NICE classification in predicting the results of histological analysis were 90.9% and 95.2%, respectively. The accuracy of NBI without magnification combined with the NICE classification in polyp characterization was 91.1%.

In contrast to this study, *Azevedo et al. (2018)* studied resect and discard /diagnose and disregard strategy for colonic polyps in community hospital using NBI and NICE classification without previous experience on 147 patients, the polyps were distributed

according histology to hyperplastic 37.5%; sessile serrated polyps 10.5%; adenoma 49.5% and carcinoma 0% and according to NICE classification hyperplastic 44 %; sessile serrated polyps 4 %; adenoma 50.5 %; carcinoma 1.5% accuracy, sensitivity, specificity, positive predictive value and negative predictive value of 78.4%, 77.4%,80%, 85.3% and 77.1%, respectively.

In this study, the masses were distributed according to its histopathological characteristics as the following, 91.8% of patients had adenocarcinoma, 6.6% with high grade dysplasia (HGD) and 1.6% with low grade dysplasia (LGD). And according to NBI via NICE classification into 4.9% had adenoma, 95.1% had malignant mass. And according to chromo endoscopy via Kudo's classification into 4.92% had adenoma, 95.08% had malignant mass. Thus, a statically significant relation between the histopatological characteristics and NBI features using NICE classification or chromo endoscopy using Kudo classification was proved (P < 0.0001). The sensitivity was 100%, specificity 60% and accuracy 96.7%.

In agreement with this results, *Wada et al. (2012)* studied diagnostic accuracy of pit pattern and vascular pattern in colorectal lesions on 584 cases revealed sensitivity 100%, specificity 71%, and accuracy 96.1%. *Fukuzawa et al. (2012)* studied Effectiveness of narrow-band imaging magnification for invasion depth in early colorectal cancer, sensitivity was 81.4% and accuracy was 92.9%.

In contrast to this study, *Sumimoto et al. (2017)* studied clinical impact and characterization of NBI magnifying

endoscopic classification of colorectal tumors by using Japanese Narrow band Expert Team (JNET) classification, sensitivity was 55.4%, specificity 99.8% but accuracy was 96.6%.

The reasons for different levels of accuracy can be multiple, for example, related to the level of expertise of physicians who performed classifications, colonoscopies equipment used, the polyp sizes and bowel preparation *(Patrun et al., 2018).*

CONCLUSION

In this study, we proved the role of NBI in detection of either colorectal polyp or mass and prediction of its histology using NICE classification. Also it is simple, accurate, applicable, and rapid in comparison to chromo endoscopy which needs stains and time consuming. Thus NBI using NICE classification can be used to avoid discarding significant lesions and removing no significant lesions that lead to less complications and more cost saving.

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تقنية الحزمه الضيقه في تصوير منظار القولون مقارنه باستخدام الصبغات والمنظار العادي فى تشخيص امراض القولون المختلفه

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خلفيــة البحــث: التصوير ضـيق النطـاق هـو تقنيـة جديـدة تسـتخدم المرشحات الضـوئية لتصـوير الغشـاء المخـاطي. وبالتـالي، يمكنـه تحديـد زوائـد/ أورام القولـون مـن خـلال نمط الحفرة ونمط الأوعية الدموية.

الهـدف مـن البحـث: تقيـيم فاعليةالتصـوير ضـيق النطـاق بالمقارنـة مـع الصـبغات والمنظار العادي للكشف عن أورام القولون والمستقيم.

المرضـى وطـرق البحـث: أجريـت هـذه الدراسـة فـي قسـم أمـراض الكبـد والجهـاز الهضـمي والأمـراض المعديـة بمستشـفى الحسـين الجـامعي، وتضـمنت الدراسـة 200 مريضًـاخلال الفتـرة مـن أبريـل 2019 إلـى نـوفمبر 2020 وباسـتخدام المنظار العـادي تـم اسـتبعاد 37 مريضـا لـديهم بواسـير داخليـه، جيـوب بـالقولون، تقرحـات بـالقولون او لـيس لـديهم تغيـرات بالمنظـار. بـاقى المرضـى 163 كـان لـديهم زوائـد / أورام القولـون، وتـم تقسـيمهم إلـى مجمـوعتين. المجموعـة الأولـى: تضـمنت 102 مريضـا لـديهم زوائـد لحميـه بـالقولون، والمجموعـة الثانيـة: 61 مريضـاً لـديهم أورام بـالقولون. وقـد خضـعت المجمـوعتـان إلـتقنيـة التصـوير ضـيق النطاقباسـتخدام تصـنيف (NICE) ثـم بالصـبغات باسـتخدام تصـنيف (Kudo) ثـم الفحـص المجهـرى للعينات.

نتـائج البحـث: توجـد علاقـة ذات دلالـة إحصـائية بـين صـفات الزوائـد/ الأورام بـالفحص المجهـرى وصـفاتها باسـتخدام تقنيـة التصـوير ضـيق النطـاق/ الصبغات.وباسـتخدام تقنيـة التصـوير ضـيق النطـاق/ الصـبغات كانـت حساسـية الزائـدة

اللحميـــة الســـرطانيه 100% والخصوصيــة 94.7% وكانـــت حساســـية الزوائـــد اللحميـــة الحميـــدة المفرطـــة 93.5% والخصوصيـــة 91.5%، بينمـــا كانـــت حساســـية الزوائـــد اللحميـــدة الحميـــدة 90.9% والخصوصـــية 89.4%، وكانـــت حساســـية الأورام السرطانيه 100% والخصوصية 60%.

الإســـتنتاج: يمكـــن أن يكتشفالتصـــوير ضـــيق النطـــاق الزوائـــد اللحميـــة/ أورام القولـــون، والتنبـــوء بنســيجها بشـــكل أســـرع وأســـهل مـــن إســتخدام الصـــبغات الـــذي يحتـــاج إلـــى وقـــت طويـــل، وبالتـــالي يمكـــن أن يقلـــل مـــن تكلفـــة النظـــام الصـــحي وخطـــر إستئصـــال الزوائـــد اللحمية.

الكلمـــات الدالـــة: الزوائـــد اللحميـــة/ أورام القولـــون، التصـــوير ضـــيق النطـــاق، المنظـــار باستخدام الصبغات.