

## ABSTRACT

**Background:** Ulcerative colitis is a chronic inflammatory condition characterized by relapsing and remitting episodes of inflammation limited to the mucosal layer of the colon. Loop ileostomy might be helpful in the management of the disease.

**Objective:** To evaluate the role of loop ileostomy in the management of ulcerative colitis.

**Methods:** Between Januarys 2008 and January 2018, patients with fulminant ulcerative colitis resistant to medical therapy had been referred to our surgical unit and were included in our study. Assessment of the patients' medical status (serum electrolytes, total serum protein, complete blood count, erythrocyte sedimentation rate, general stool exam, and abdominal ultrasound and x-rays) and psychological status were done and then preoperative status correction followed by defunctioning loop ileostomy operated upon them and followed postoperatively in hospital for the response for two weeks of hospitalization.

**Results:** Twenty patients were included in the study, two patients died postoperatively due to comorbidities and pulmonary embolism. Eighteen of twenty patients had a gradual improvement clinically (mucus diarrhea

with/without blood, weight gain, fever, psychological and edema) and in hematological and biochemical values (complete blood count, serum albumin protein, erythrocyte sedimentation rate and electrolytes) within two weeks.

**Conclusion:** Defunctioning loop ileostomy is a simple, less morbid procedure if compared to other medical treatments which can change the complication features of fulminant ulcerative colitis towards either continue in medical therapy or towards definitive curative surgery and cost effective as it decrease the need for expensive medications.

**Keywords:** Defunctioning loop ileostomy, fulminant Ulcerative Colitis, ulcerative colitis complications.

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Received at 18/5/2019

Accepted at 10/7/2019

## INTRODUCTION

Ulcerative colitis (U.C) is an inflammatory bowel disease which was thought previously to be of little incidence in Iraq, but recent researches show that it's relatively of common incidence in the Iraqi society<sup>(1)</sup>.

It is a chronic inflammatory condition characterized by relapsing and remitting episodes of inflammation limited to the mucosal layer of the colon. It almost invariably involves the rectum, and may extend in a proximal and continuous fashion to involve other portions of the colon, patients with severe presentations of U.C. are generally categorized as fulminant ulcerative colitis when patients with severe ulcerative colitis have more than 10 stools per day, continuous bleeding, abdominal pain, distension, and acute, severe toxic symptoms including fever and anorexia, such patients are at risk of progressing to toxic megacolon and bowel perforation were intervention must take place.<sup>(2-4)</sup>

It is a chronic relapsing disease with different modes of presentation (mild, moderate, severe, and fulminant) and different modes of progress and response to therapy, the medical and gastroenterology units start the initial steps of diagnosis (clinically, endoscopically and

histopathologically) and when possible, patients should be managed with aggressive medical therapy, though in some surgery will be required.

In addition to proper nutritional assessment and support, a colorectal surgeon should be contacted and involved early in the patient's admission. Surgery is indicated for patients who have life-threatening complications of severe ulcerative colitis, such as massive bleeding, perforation, or infection, also it may be necessary for those who have fulminant or chronic severe colitis that fails to improve with intravenous steroids and/or biologic therapy. It is important that patients had tried all reasonable medical therapies prior to considering colectomy and when medical treatment fail to induce a response (resistant cases) to all these treatment modalities then they are referred for surgical management.<sup>(2-5)</sup>

Those patients who are not candidates for definitive surgery (total proctocolectomy), with high mortality rates and can't afford treatment (total parenteral nutrition and biological treatment) were candidate for our research study by diverting the intestinal contents from the diseased colonic mucosa to allow the inflammatory process to settle down by doing a simple defunctioning

loop ileostomy (DLI); which is relatively cheap, simple, short procedure and with little morbidity and mortality; aiming to give them high chance of recovering from their symptoms and signs and build up their body stores, as a preliminary step either to do definite surgery later on or to retry other routes of medical therapy<sup>(4-7)</sup>.

In the developing country were the beds of advanced intensive care units to keep these patients for long periods of time on total parenteral nutrition (TPN) waiting for response of medical methods therapy are affordable, and most of these patients are incapable of affording the expenses of the TPN and the new drug regimens, it is important to exclude alternative and/or comorbid conditions as a cause for their symptoms and the evaluation should consist of laboratory studies, stool studies, flexible sigmoidoscopy, and plain abdominal radiography<sup>(6,8,9)</sup>. Then defunctioning loop ileostomy procedure was the alternative solution for these patients as they will have the chance of either a second trial of medical therapy or towards less life threatening definitive surgery.

Initial therapy of patients with fulminant colitis should be admitted to a hospital and followed closely with vital signs and physical examination every four to six hours to evaluate abdominal and rebound tenderness and more frequently if there is clinical deterioration. Stool output should be recorded to chart the number and character of bowel movements, including the presence or absence of blood and liquid versus solid stool. A complete blood count, serum electrolytes, serum albumin, liver function tests, and erythrocyte sedimentation rate (ESR) and C-reactive protein should be checked every 12 to 24 hours and more frequently if there is clinical deterioration. Patients should be managed by gastroenterologists and colorectal surgeon<sup>(10-11)</sup>.

Patients with U.C. should be kept nothing per mouth (NPO) and nutritional support should be considered if the patient is malnourished. Intravenous fluid and electrolyte replacement are necessary to correct and prevent dehydration or electrolyte imbalance. Blood transfusions may be needed to maintain a hemoglobin  $\geq 10$  g/dL while patients with intestinal dilation (transverse colon diameter  $\geq 5.5$  cm) should receive decompression with a nasoenteric tube. Intermittent rolling maneuvers every two hours or the knee-elbow position should be recommended to help redistribute gas in the colon and thereby promote decompression and a plain abdominal radiography should be repeated if there is clinical deterioration to determine if there is colonic dilation (diameter

$\geq 5.5$  cm) or toxic megacolon (diameter  $\geq 6$  cm or cecum  $>9$  cm and systemic toxicity)<sup>(12,13)</sup>.

Patients with fulminant colitis should be treated with intravenous glucocorticoids. Prednisolone (30 mg IV every 12 hours) or methylprednisolone (16 to 20 mg IV every eight hours) are preferred because they produce less sodium-retention and potassium-wasting and all patients should be treated with broad-spectrum antibiotics (eg, ciprofloxacin 400 mg every 12 hours [or ceftriaxone 1000 mg daily] and metronidazole 500 mg every eight hours) intravenously.<sup>(12)</sup>

All patients should receive pharmacological venous thromboembolism prophylaxis (enoxaparin 4000 I.U.) to reduce the risk of thromboembolism<sup>(14-16)</sup>.

Subsequent therapy of fulminant U.C. who fail to improve by the third day of intensive treatment should be managed as patients with steroid-refractory U.C. with either cyclosporine or infliximab, or undergo colectomy. However, the threshold to undergo colectomy in patients who fail to respond to cyclosporine or infliximab is lower. Intravenous cyclosporine has a role in induction of remission in patients with severe or fulminant colitis, but is not effective and/or safe for long-term use<sup>(17, 18)</sup>.

Cyclosporine is used as a short-term "bridge" to therapy with the slower onset, longer acting medications, including azathioprine (AZA) or 6-mercaptopurine (6-MP), while infliximab can induce remission rapidly and can be used for the maintenance of remission [30]. However, it is unclear if anti-tumor necrosis factor (anti-TNF) therapy can prevent or reduce rates of colectomy in the long term, therefore suggest infliximab in patients with an allergy to AZA/6-MP or who have failed to AZA/6-MP<sup>(19)</sup>.

Patients with fulminant colitis who fail treatment with cyclosporine or infliximab (either due to a failure to respond or due to relapse) within four to seven days and those with toxic megacolon (diameter  $\geq 6$  cm or cecum  $>9$  cm and systemic toxicity) who do not respond to therapy within 72 hours, require colectomy<sup>(20)</sup>.

## METHODS

This prospective longitudinal study was conducted in Imam Ali general hospital in Al-Sadder city, Baghdad during January 2014 and January 2018 were patients suffering from fulminant ulcerative colitis referred to our surgical unit for surgical management.

Disease history including geodemographic information clinical assessment of the patients clinical condition radiologically, symptoms

and signs that includes diarrhea which was scored by Likert score, psychological insult was assessed by our psychologist team and for mucus discharge per- anus, bleeding per- anus, appetite, vomiting, weight loss, generalized edema, fever, , extra-intestinal manifestations (uveitis, arthropathy) with their medical parameters including hemoglobin, serum electrolytes, total serum protein, and erythrocyte sedimentation rate (ESR). After overall assessment a decision was made by authorized surgeon to do DLI according to the Practice Parameters Committee of the American College of Gastroenterology, the procedure details is illustrated below. All patients were followed for two weeks and re-assessment was made to find out significance of difference and association between related measured variables. The indications for DLI were refusal of doing colectomy (can't afford non-surgical treatment modalities of fulminant U.C. were included in this category) and/or their medical condition can't withstand colectomy operation (no intensive care unit beds after operation vacancy), all those patients were subjected for DLI as an alternative procedure and to give them another chance of proper surgical or non-surgical management later on. The perioperative preparation was done according to the Practice Parameters Committee of the American College of Gastroenterology<sup>(9, 12, 13, 14, 20, 21, 22)</sup>.

Ethical consideration of proposal of research was approved by the scientific and ethical comity in the Al-Resafa general directorate/Al-Imam Ali general hospital. Agreement of scientific committee in Al-Imam Ali general hospital and health authority in the hospital was taken before starting the study.

A written consent was taken from each included patient after full explanation of the aim of the study and insuring the patients about the confidentiality of the collected data telling the patients that this data will be anonymous and will not be used but for the research purposes.

The surgical procedure of loop ileostomy was done by multidisciplinary team for the preoperative preparations and correction of the following parameters:

- 1- Hemoglobin more than 11 g/dl and ESR less than 30.
- 2- Normal standard reference electrolytes of sodium, chloride and potassium.
- 3- Normal serum proteins-albumin (>1.8 gm/dl).
- 4- Hydration and psychological support.
- 5- Antibiotics therapy were given (ceftriaxone 1 gm twice daily and metronidazole 500 mg 8 hourly) intravenously.

6- Medical conditions (renal, ischemic heart and blood diseases and respiratory diseases) control.

7- All patients were given perioperative enoxaparin 4000 I.U. subcutaneously 2 days before surgery and continued till mobility was resumed by the patients.

Surgical operations were done by using a right Mc Burney incision in all cases, with spinal anesthesia and the ileostomy is covered by an ileostomy base and a bag on operative table, usually it will start to function between 24-48 hours. Antibiotics (ceftriaxone 1gm and metronidazole 500mg) were given for five-seven days, fluid therapy was given to all patients according to the electrolytes results which was done every 6 hours for the first 48 hours and albumin and fresh frozen plasma were given according to the results of patients total serum protein levels. Patients are allowed for oral fluids intake after 48 hours as nasoenteric tubes were removed, returned back to high protein diet after 5<sup>th</sup> – 7<sup>th</sup> postoperative day and the patients were hospitalized and followed for 2 weeks.

Statistical analysis was made for the collected data and introduced into Microsoft excel sheet and loaded into IDM-SPSS V24. Descriptive statistics were presented by using means  $\pm$ SD and frequency distribution tables with graphs while paired sample T-test was used to find out the significance of statistical difference between means of measured variables at pre and post-operative times, P. value < 0.05 was considered as cutoff point of significance.

## RESULT

Among the 20 patients that were included, 2 patients died due to postoperative thromboembolism although they were on enoxaparin 4000 I.U. subcutaneously daily dose as they had medical heart problems so they were ruled out from this study.

The age of studied patients was ranging between 18 – 58 years with a mean age group of 36 ( $\pm$  9.9). Twelve (67%) patients were males.

The general approval or/and medical conditions (table 1) of these patients did not allow doing definitive major procedure (colectomy) for them at that time due to the limited intensive care units beds or due to their medical conditions of high morbidity and mortality (15 patients), or because patients refuse doing total colectomy (3 patients). So we managed these patients by doing diversion by DLI.

**Table 1: Causes of doing defunctioning loop ileostomy**

Cause of operation	Total	%
Medical conditions/ICU beds vacancy	15	83.33
Refuse colectomy	3	16.67

The XR caecum/colon size measured before operation showed that colon diameter was enlarged (6-9 cm), caecum diameter was also

enlarged (9-12 cm). But postoperatively the diameter of cecum was decreased to 4 cm and colonic diameter to 3 cm in all patients

**Table 3 Paired sample t test showed differences between means of different variables before and after surgery**

		Mean	SD	95% CI		P value
				Lower	Upper	
<b>HB g/dl</b>	Preoperative	9.06	0.50	2.16	2.46	0.001
	Postoperative	11.38	0.33			
<b>ESR</b>	Preoperative	59.6	7.2	-50.78	-44.54	0.001
	Postoperative	11.94	2.53			
<b>Sodium mEq/L</b>	Preoperative	127.94	8.05	9.50	11.27	0.001
	Postoperative	138.33	9.13			
<b>Chloride mEq/L</b>	Preoperative	94.94	1.95	4.80	6.08	0.001
	Postoperative	100.39	1.91			
<b>Potassium mEq/L</b>	Preoperative	3.36	0.15	0.76	1.98	0.001
	Postoperative	4.73	1.23			
<b>TSP g/dl</b>	Preoperative	1.57	0.20	2.05	2.64	0.001
	Postoperative	3.92	0.54			
<b>Appetite 1/10 scale</b>	Preoperative	1.83	0.86	6.8	7.75	0.001
	Postoperative	9.11	0.18			

Figure 3 and table 3 showed the distribution of studied patients according to their hemoglobin levels at preoperative and at the last day of follow up postoperatively. All patients got anemia (Hb <10mg/dl, mean=9.06±0.5mg/dl) while all patients get rid of anemia at last Hb measurement (Hb>10, mean=11.38±0.33mg/dl). Paired sample t-test showed that statistically significant increase in the level of patients Hb postoperatively, P value <0.001.

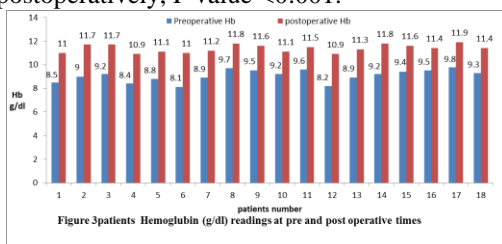
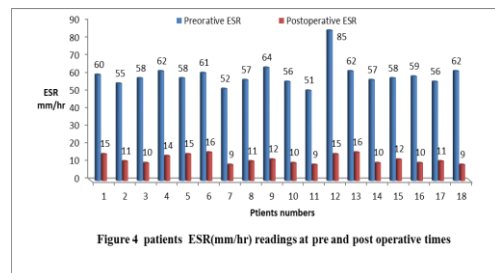
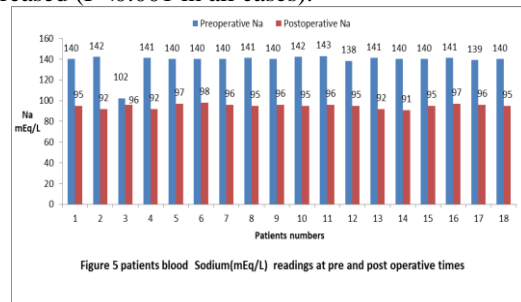


Figure 4 and table 3 showed the distribution of studied patients according to their ESR levels at preoperative and at the last day of follow up postoperatively. All patients got elevated ESR (ESR >50mm/hr, mean=59.6±7.2mg/dl) while all patients get decreased ESR at last follow up day measurement (ESR<20, mean= 11.94±2.53mg/dl). Paired sample t-test showed that statistically significant decrease in the level of patients ESR postoperatively, P value <0.001.



Figures 5-7 and table 3 showed that patients' blood electrolytes like sodium, chloride and potassium were subnormal preoperatively: mean Na=127.94±8.05 mEq/L, mean Cl=94.94±1.95mEq/L and mean K=3.36±0.15mEq/L. While postoperatively the blood levels of all previously mentioned electrolytes were significantly increased (P<0.001 in all cases).



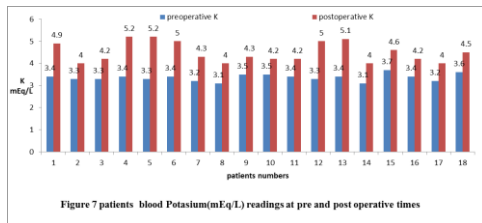
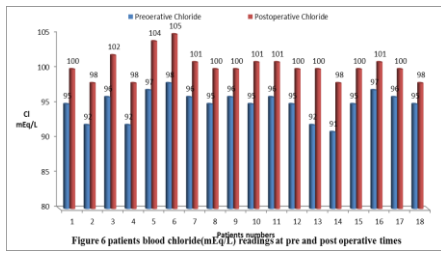


Figure 8 and table 3 showed the distribution of studied patients according to their total serum protein levels at preoperative and at the last day of follow up postoperatively. All patients got hypoproteinemia preoperatively (TSP <2 g/dl, mean=1.57±0.2g/dl) while all patients serum protein was improved at last measurement (TSP>3.1g/dl, mean= 3.92±0.54g/dl). Paired sample t-test showed that statistically significant

increase in the level of patients TSP postoperatively, P value <0.001.

Figure 9 and table 3 showed the distribution of studied patients according to their appetite levels measured on 1-10 score at preoperative and at the last day of follow up postoperatively. All patients got anorexia (appetite score<4, mean=1.83±0.86) while all patients get rid of anorexia at last measurement (appetite>7, mean= 9.11±0.18). Paired sample t-test showed that statistically significant increase in the level of patients appetite postoperatively, P value <0.001.

All patients had severe bloody/mucous diarrhea, malnourished, feverish, had generalized edema and psychological insult. Almost all patients started to show remarkable improvement in their general condition at the 5<sup>th</sup> postoperative day as diarrhea stopped but some mucus discharge mixed with light blood continued through the two hospitalized weeks, gross bleeding per-rectum almost stopped, leg edema disappeared, and weight started to increase (Table 4),

**Table (4): Changing in clinical features before and after DLI.**

Symptoms & Signs	Before	After
<b>Concern of Diarrhea</b>	Severe (16) Moderate (2)	No diarrhea (16) Mild (2)
<b>Mucus discharge per-anus</b>	Marked (18)	Infrequent (17) Mild (1)
<b>Bleeding per-anus</b>	Gross bleeding (18)	Infrequent (17) Mild (1)
<b>Vomiting</b>	Sometime	Absent
<b>Weight</b>	Under weight	Gaining weight
<b>Generalized edema</b>	Moderate 15 Mild 3	Absent 18
<b>Fever</b>	Present (>37.5)	Absent
<b>Psychological status</b>	Depression and irritability (15) Suicidal thoughts (3)	Uncomfortable from the stoma and/or shy from it (18)
<b>Extra-intestinal manifestations (uveitis, arthropathy)</b>	Present (16) Not present (2)	Present (16) Not present (2)

All patients had their previous long term steroid treatment were stopped gradually within the 2 weeks post-operatively and during which they return to medical treatment.

**DISCUSSION**

Fulminant and complicated UC patients are very fragile patients with high mortality and morbidity, they need to be kept on medical/biological therapy trials and if without response they need a definitive major surgery (colectomy) with high risk and affecting life style<sup>(3, 4)</sup>.

Managing Iraqi patients of fulminant UC who can't afford medical/biological treatment fees, refuse doing colectomy operation or their medical conditions needs intensive care units beds that were unavailable at their time of admission all were managed by defunctioning loop ileostomy to overcome the resistance to medical/biological therapy and delay the urgency of definitive surgery with high risk.

Defunctioning loop ileostomy is simple, relatively cheap surgery with low relative risk on patients' life and usually done by spinal anesthesia so intensive care units are not recommended for

it. Defunctioning loop ileostomy will divert intestinal contents from the colon so will give high chance for UC resistant mucosa to have rest and its inflammatory process to subside gradually leading to dramatic improvement in UC features and the systemic features of the patients<sup>(3,23)</sup>.

Regarding UC features after DLI, the diarrhea stopped within five days so the dehydration and electrolytes disturbances was improved, also mucus discharge subsided gradually so restoring precious materials loss (serum protein, serum albumin, and electrolytes), and bleeding per-rectum almost stopped gradually so the patients start regaining his (or her) hemoglobin levels.

Regarding systemic features after defunctioning loop ileostomy, the patients show dramatic turn over within seven days, so fever subsided, vomiting stopped, appetite improved, generalized edema disappeared, and the psychological depression and irritability to little anxiety only (mostly from the stoma).

But we notice that the extra-intestinal manifestations of UC as uveitis and arthropathy did not change in spite of improved colonic and systemic features of the patients and these results resemble other world studies of these manifestations following colectomy.<sup>(1, 21)</sup>

As a result of improving local and systemic manifestations, the blood laboratorial values will start to correct gradually, the hemoglobin, serum albumin, ESR and serum electrolytes (which had been done in every other day check) of the patients post-defunctioning loop ileostomy will start improving within 7 days after surgery.

This study confirms the low incidence of morbidity and the great benefit associated with the formation of the DLI in the severely ill and resistant patients of UC disease, those patients cannot withstand any major surgical procedures specially when they are receiving very high and prolonged doses of steroids and biological therapy, anemic, low serum proteins and cachectic with generalized edema.

All the patients in our study had their treatment gradually stopped within 2-8 weeks; and within 2-4 months they started to gain weight and tolerate high calories diet and turned to positive nitrogen balance status (build up their proteins), so they become fit for safe definitive surgery (total proctocolectomy with ileal reservoir) with low complication rate.

Although no similar study had been done on the role of defunctioning loop ileostomy without colectomy was found in reviews of management of fulminant U.C., which may be to the world health capabilities services available, this may help to

give a clue to an economically affordable price management that can help these patients especially these who refuse doing colectomy.

## CONCLUSION

- 1- Defunctioning loop ileostomy is simple surgery, low risk, less traumatic, and can be done with spinal anesthesia safely for resistant and fulminant UC patients to improve their clinical features and avoid further UC complications and prepare them for the definitive major UC surgery.
- 2- Defunctioning loop ileostomy might be a treatment option in resistant UC cases to stop unnecessary prolonged medical therapy and avoid deterioration and decrease hospital stay.
- 3- High costs of medical/biological as well as definitive UC surgical operation on patients behave can be reduced by doing DLI.

## REFERENCES

1. Zainob Mohammed. Immunological studies on ulcerative colitis on Iraqi patients. *J Clin Cell Immunol*, DOI: 2010.4172/2155-9899.S 1.009.
2. Muhammed Y. Shafeek, Khitam R. Al-Khafaji, Luay E. Al-Khurri, Aswad Al-Obedy. Ulcerative Colitis An endoscopic and histopathological Comparison Study. *IJGE Issue 6, Vol 1, 2006*.
3. Kornbluth A., Sacher D.B. Ulcerative Colitis practice guidelines in adults (update): American College of Gastroenterology, practice parameters Committee. *Am J Gastroenterol* Mar 2010, 105(3): 501-23.
4. Katz S. My Treatment Approach to the Management of Ulcerative Colitis. *Mayo Clinic Proceedings*. Aug 2013; Vol 88, Issue 8, pages 841-853.
5. Katz S. Update in medical therapy of ulcerative colitis: a practical approach. *J Clin Gastroenterol* 2002; (34) 397-407.
6. Heuschen Udo A., Hunz ULF, et al. One or two-stage procedure for Restorative Proctocolectomy: Rationale for a Surgical Strategy in Ulcerative Colitis. *Annals of Surgery*: Dec. 2001, Vol. 234, Issue 6, pp 788-74.
7. Remzi F.H., Fazio V.W., et al. The outcome after restorative proctocolectomy with or without defunctioning ileostomy. *Dis Colon Rectum*. Apr 2006; 49 (4): 470-477.
8. Zuhair R Al-Bahrani. Total colectomy and ileo-rectal anastomosis versus total procto-colectomy and ileo-anal (j) pouch anastomosis for ulcerative colitis. *Iraqi postgraduate Medical Journal*. ISSN: 16088360, year: 2006, vol 5, Issue: 4, pages: 364-370
9. JI Cohen, SA Strong, NH Hyman, WD Buie. Practice parameters for the surgical treatment of ulcerative colitis. *Diseases of the colon and rectum*

- 48 (11) pp (1997-2009), 2005.
10. Mowat C, Cole A, Windsor A, et al. Guidelines for the management of inflammatory bowel disease in adults. *Gut* 2011; 60:571.
  11. Murthy SK, Steinhart AH, Tinmouth J, et al. Impact of gastroenterologist care on health outcomes of hospitalised ulcerative colitis patients. *Gut* 2012; 61:1410.
  12. Present DH, Wolfson D, Gelernt IM, et al. Medical decompression of toxic megacolon by "rolling". A new technique of decompression with favorable long-term follow-up. *J Clin Gastroenterol* 1988; 10:485.
  13. Panos MZ, Wood MJ, Asquith P. Toxic megacolon: the knee-elbow position relieves bowel distension. *Gut* 1993; 34:1726.
  14. Carter MJ, Lobo AJ, Travis SP, IBD Section, British Society of Gastroenterology. Guidelines for the management of inflammatory bowel disease in adults. *Gut* 2004; 53 Suppl 5:V1.
  15. Geerts WH, Bergqvist D, Pineo GF, et al. Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest* 2008; 133:381S.
  16. Irving PM, Pasi KJ, Rampton DS. Thrombosis and inflammatory bowel disease. *Clin Gastroenterol Hepatol* 2005; 3:617.
  17. Moskovitz DN, Van Assche G, Maenhout B, et al. Incidence of colectomy during long-term follow-up after cyclosporine-induced remission of severe ulcerative colitis. *Clin Gastroenterol Hepatol* 2006; 4:760.
  18. Cohen RD. How should we treat severe acute steroid-refractory ulcerative colitis? *Inflamm Bowel Dis* 2009; 15:150.
  19. Sandborn WJ. A review of immune modifier therapy for inflammatory bowel disease: azathioprine, 6-mercaptopurine, cyclosporine, and methotrexate. *Am J Gastroenterol* 1996; 91:423.
  20. Kornbluth A., Sachar D.B. and the Practice Parameters Committee of the American College of Gastroenterology: Erratum: Ulcerative Colitis Practice Guidelines in Adults: American College of Gastroenterology, Practice Parameters Committee. *Am J Gastroenterol* 2010; 105: 500-523.
  21. Khalid A. Al-Khazraji. Descriptive study of extragastrointestinal manifestations of ulcerative colitis and their relation to disease activity in 100 Iraqi patients. *Journal of the faculty of medicine*, ISSN: 00419419, year: 2011, Vol. 53, Issue: 1, pages: 24-28.
  22. Cima R.R., Pemberton J.H. Surgical indications and procedures in ulcerative Colitis. *Curr Treat Options Gastroenterol*. Jun 2004; 7(3): 181-190.
  23. Winslet MC, Drolc Z, et al. Assessment of the defunctioning efficiency of the loop ileostomy. *Dis Colon Rectum* 34: 699, 1991.