

Post-operative ileus in hemicolectomy for cancer: open versus laparoscopic approach



Ann. Ital. Chir., 2012 83: 557-562
pii: S0003469X13019222

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AIM: *This study aims to verify if the duration of postoperative ileus (POI), in patients undergoing abdominal surgery, is related to the surgical approach used (open or laparoscopic) or rather to the manipulation of bowel loops.*

MATERIALS AND METHODS: *Ninety patients, undergoing elective colon resection for cancer, were randomized in three groups with different surgical approaches: open technique with extensive manipulation of intestinal loops (GROUP A), open technique with minimal manipulation (GROUP B) and laparoscopic technique (GROUP C). Return of bowel functions was investigated by: detection of bowel sounds, passage of flatus and passage of stool.*

RESULTS: *Detection of bowel sounds occurred after 2.18 days in GROUP A, after 1.35 days in GROUP B and after 1.19 days in GROUP C. Return of flatus occurred after 3.51 days in Group A, after 2.53 days in GROUP B and after 2.30 days in GROUP C. Passage of stool occurred after 4.48 days in GROUP A, after 3.75 days in GROUP B and after 3.61 days in GROUP C. In all end-points analyzed, differences between GROUP A and GROUP B and between GROUP A and GROUP C are significant ($P < 0.01$) whereas the differences between GROUP B and GROUP C are not significant ($P > 0.01$).*

CONCLUSIONS: *In colon surgery open technique with minimal manipulation of loops obtains similar results in those of the laparoscopic technique, in terms of resolution of postoperative ileus.*

KEY WORDS: Hemicolectomy, Post-operative Ileus

Introduction

Postoperative inhibition of bowel function is a frequent problem in the management of patients undergoing abdominal surgery¹⁻³.

This condition, called postoperative ileus (POI), is characterized by the delayed passage of flatus or stool, inability

to tolerate oral intake and sometimes nausea, vomiting and abdominal distension².

Multiple factors contribute to the pathogenesis of POI and several studies show that bowel motility is re-established earlier in patients operated with the laparoscopic approach than with the open technique^{4,5}.

The recovery of bowel motility after abdominal surgery allows the patient to return to oral intake with all the benefits associated and is an important prognostic index⁶. The delayed recovery of intestinal motility, in fact, should be considered an alarm bell⁷ for the onset of metabolic, hemorrhagic, ischemic, occlusive or inflammatory complications. This study aims to verify if the duration of postoperative ileus is related to the technique used (open or laparoscopic) or rather to the more or less extensive manipulation of the bowel loops.

Pervenuto in Redazione Marzo 2012. Accettato per la pubblicazione Giugno 2012

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Materials and methods

Patients scheduled for elective colon resection for colon cancer between 2007 and 2010 were included in the study. Patients were followed in the General and Endocrine Surgical Unit at University of Rome La Sapienza, Italy.

Data regarding patient's age, cancer location, procedure performed, operative time, incision length, postoperative bowel function (detection of bowel sounds, return of flatus and passage of stool), complications and day of discharge were collected prospectively.

POPULATION

The population includes 90 patients, 43 females and 47 males aged between 31 and 86 years (mean age 66.09 years).

Pre-random: inclusion and exclusion criteria for enrolment in the study are listed in Table I.

Cancer location was: ascending colon or proximal transverse colon in 37 cases, in these cases a right hemicolectomy with ileo-transverse-stomy TT was performed; descending colon, distal transverse or sigmoid in 53 cases, in these cases left hemicolectomy with colo-rectal-stomy TT was performed.

Three different approaches were used: laparoscopic technique, open technique with exposure of the intestinal loops outside the abdominal cavity, (extensive manipulation) open technique without exposure of the intestinal loops (minimal manipulation) loops were positioned in left or right ipocondrium, respectively for right or left hemicolectomy, and covered with warmed wet laparoscopic gauze. In right or left hemicolectomy the degree of exposure and manipulation of intestinal loops was the same.

TABLE I - Inclusion and exclusion criteria for enrolment in the study.

INCLUSION CRITERIA

Tumor of colon

Elective resection by right or left hemicolectomy

EXCLUSION CRITERIA

Rectum resection, abdominoperineal rectum extirpation, total colectomy

Tumor infiltration of adjacent organs

Anaesthesia risk > ASA III

BMI > 32 kg/m²

Synchronous second tumor in extracolonic location

Coagulopathy not responding to treatment

Intestinal obstruction

Transverse tumor diameter more than 8 cm on CT

Pharmacological therapy with drugs disturbing bowel motility

Immunopathy

All patients were informed both orally and in writing about the 3 different surgical techniques and written informed consent was obtained from all patients.

All patients were randomized to open procedure with extensive manipulation, open procedure with minimal manipulation or laparoscopic procedure. Exclusion criteria after randomization were also established at: major complications, laparoscopic technique converted to open technique.

In the week preceding intervention patients observed low residue diet. Preoperative bowel preparation was performed with simeticone 40 mg, 2 tablets twice a day.

In all cases total anesthesia was performed with administration of Propofol, Fentanyl and Sevoflurane by the same anesthesiological team.

In all patients a nasogastric tube was applied at the beginning of operation and it was removed after bowel sounds were detected. Postoperative, the nasogastric tube was repositioned in patients when vomiting (at least 200 ml) occurred. Postoperative analgesia was administered with paracetamol for 24 hours after intervention by antalgic elastomer and subsequently with 100 ml, 10 mg/ml, i.v. of paracetamol when requested by the patient.

Fluid administration was standardized to 1500 ml of isotonic saline and 500 ml of hydroxyethyl starch, unless blood tests indicated otherwise.

At the return of flatus, a semi-liquid diet was permitted. The return of bowel sounds was investigated, from the first postoperative day, by daily auscultation of the abdominal quadrants for 3 consecutive minutes at eight a.m., four p.m. and midnight. Timing of the first passage of flatus and passage of stool was also recorded.

STATISTICAL ANALYSIS

The differences among timing of bowel sounds detection, passage of flatus and passage of stool in the three groups were analyzed with unpaired *t*-test for population with unequal standard deviations and one-way analysis of variance test. *P* value < 0,01 was considered statistically significant.

Results

Preoperative randomization assigned 30 patients to open technique with exposure of the intestinal loops outside the abdominal cavity (GROUP A), 30 patients to open technique without exposure of the intestinal loops (GROUP B) and 30 patients to laparoscopic technique (GROUP C). Groups are listed in Table II.

The groups of patients with different surgical approaches are matchable in age, sex, body mass index (BMI), stage of cancer, anesthesia risk according to the ASA classification (American Society of Anesthesiologist). Mortality was nil in all groups.

TABLE II - Patients randomized

GROUP A Open with exposure	GROUP B Open without exposure	GROUP C Laparoscopic
Right Hemicolectomy: 12 Left Hemicolectomy: 18	Right Hemicolectomy: 13 Left Hemicolectomy: 17	Right Hemicolectomy: 12 Left Hemicolectomy: 18
Total: 30	Total: 30	Total: 30

TABLE III - Patients excluded after randomization.

Group A Patients Excluded	Group B Patients Excluded	Group C Patients Excluded
Sub-occlusion L Anastomosis dehiscence L Eventration R	Anastomosis dehiscence L Acute pulmonary embolism L	Lesion of ureter L Epigastric a.hemorrhage R Hemoperitoneum + *Severe Adesions R *Poor tolerance of pneumoperitoneum L
Right colectomy excluded: 1 Left colectomy excluded: 2 TOTAL EXCLUDED: 3	Right colectomy excluded: 0 Left colectomy excluded: 2 TOTAL EXCLUDED: 2	Right colectomy excluded: 2 Left colectomy excluded: 2 TOTAL EXCLUDED: 4

Legend: * = laparoscopic converted to open; R = right hemicolectomy; L = left hemicolectomy

Nine patients were excluded after randomization because of major postoperative complications and laparoscopic interventions converted to open technique.

Postoperative complications occurred in eight patients. In GROUP A, three complications: sub-occlusion, eventration, colo-rectal anastomosis dehiscence. In GROUP B, two complications: acute pulmonary embolism and colo-rectal anastomosis dehiscence. In GROUP C, three complications: lesion of the left ureter, hematoma from epigastric artery hemorrhage, hemoperitoneum in patients (converted to open procedure for severe adhesions).

In one additional case, laparoscopic technique was converted to open technique because of poor tolerance of the pneumoperitoneum (Table II).

In GROUP A, eleven patients underwent right hemicolectomy and sixteen underwent left hemicolectomy. In GROUP B, thirteen patients underwent right hemicolectomy and 15 underwent left hemicolectomy.

In GROUP C, right hemicolectomy was performed in ten cases and left hemicolectomy in sixteen cases (Table IV).

Operative Time

Mean operative time was 2.5 hours for open procedure with exposure of the intestinal loops outside the abdominal cavity (GROUP A), 2.7 hours for the open procedure without exposure of the intestinal loops (GROUP B) and 3.6 hours for the laparoscopic procedure (GROUP C).

Incision Length

The mean total length of the abdominal incisions in GROUP C was 6 cm ± 4, in GROUPS A and B 18 cm ± 6.

BOWEL FUNCTION Detection of bowel sounds occurred after 1.58 days (range 1-4) in the total population.

In patients undergoing right hemicolectomy detection of bowel sounds occurred after 1.61 days (range 1-3) and in patients undergoing left hemicolectomy after 1.55 days (range 1-4); the difference between these groups is not significant (P > 0,01).

In GROUP A detection of bowel sounds occurred after 2.18 days (range 1-4), in GROUP B after 1.35 days (range 1-3) and in GROUP C after 1.19 days (range 1-3). The difference between GROUP A and GROUP B and between GROUP A and GROUP C is statistically significant (P < 0,01) while the difference between GROUP B and GROUP C is not statistically significant (P > 0,01). Return of flatus occurred after 2.79 days (range 1-5) in the total population.

In patients undergoing right hemicolectomy return of flatus occurred after 2.64 days (range 1-5) and in patients undergoing left hemicolectomy after 2.80 days (range 1-5). The difference between these groups is not statistically significant (P > 0,01).

In GROUP A return of flatus occurred after 3.51 days (range 2-5), in GROUP B after 2.53 days (range 1-5) and in GROUP C after 2.30 days (range 1-4). The differences

TABLE IV - Groups patients included after randomization.

GROUP A	GROUP B	GROUP C
Right Hemicolectomy: 11 Left Hemicolectomy: 16	Right Hemicolectomy: 13 Left Hemicolectomy: 15	Right Hemicolectomy: 10 Left Hemicolectomy: 16
Total: 27	Total: 28	Total: 26

TABLE V - Return of bowel function. Results in POD: Post-Operative Day

	Bowel Sounds	Flatus	Passage of Stool
Total	1.58	2.79	3.95
Right	1.61	2.64	3.97
Left	1.55	2.80	3.93
Group A	2.18	3.51	4.48
Group B	1.35	2.53	3.75
Group C	1.19	2.30	3.61

between GROUP A and GROUP B and between GROUP A and GROUP C are statistically significant ($P < 0,01$) while the difference between GROUP B and GROUP C is not statistically significant ($P > 0,01$).

Passage of stool occurred after 3.95 days (range 2-7) in total population.

In patients undergoing right hemicolectomy passage of stool occurred after 3.97 days (range 2-7) and in patients undergoing left hemicolectomy after 3.93 days (range 2-6). The difference between these groups is not statistically significant ($P > 0,01$).

In GROUP A passage of stool occurred after 4.48 days (range 3-7), in GROUP B after 3.75 days (range 2-6) and in GROUP C after 3.61 days (range 2-6). The differences between GROUP A and GROUP B and between GROUP A and GROUP C are statistically significant ($P < 0,01$) and the difference between GROUP B and GROUP C is not statistically significant ($P > 0,01$). Results are listed in Table V.

Repositioning of the nasogastric tube was not required in any case.

In GROUP A patients were discharged after 8.51 days (range 7-10), in GROUP B after 7.64 days (range 7-9) and in GROUP C after 6.61 days (range 6-8). Patients discharged were able to eat a regular diet.

Discussion

A consensus conference in 2006 defined the postoperative ileus (POI) as: "transient cessation of coordinated bowel motility after surgical intervention, which prevents effective transit of intestinal contents or tolerance of oral intake" ^{2,8}.

Primary POI was defined as such a cessation occurring in the absence of precipitating complications. In this case, inhibition of bowel motility is transient and is resolved in 24-72 hours and is considered an inevitable response to abdominal trauma. Secondary POI was instead defined as cessation occurring in the presence of a precipitating complication (infection, anastomotic leak) or of peritoneal and visceral diseases, and not resolving spontaneously but after resolution of the underlying cause ^{2,9}.

Postoperative ileus is the result of concurrence of neurological, inflammatory, hormonal and pharmacological mechanisms ^{2,4,9,10-12}. It has surgical trauma as a causal factor, but the importance and influence of each of these factors remain to be defined ^{2,9}.

Patients undergoing major abdominal surgery have the highest probability of developing POI, probably related to the degree and the length of manipulation of intestinal loops and their exposure outside the abdominal cavity ^{1,7,13}.

Determination of the end of POI is somewhat controversial and different studies have used different end points, each with its advantages and weaknesses ⁹. Reappearance of bowel sounds is often seen as a sign of the end of POI, but this method requires frequent auscultation and does not necessarily indicate presence of complete propulsive activity. Flatus is not an ideal endpoint because it requires a conscious and cooperative patient who can reliably report its occurrence to the investigator. Passage of stool can be considered a reliable end point, but its delay does not necessarily indicate absence of bowel function. However, these functions all together allow to determine the timing of resolution of the postoperative ileus and can be used to evaluate ability to restore oral feeding and postoperative prognosis ^{4,6,9,14,15}.

Bowel motility can also be investigated by instrumental methods such as barostato-manometry, study of transit time by radio-opaque markers and bipolar electrodes ^{4,14,15}. These methods are costly and less tolerated or accepted by patients for their invasiveness.

In this study we recorded three end points: detection of bowel sounds by auscultation of the abdomen quadrants for 3 consecutive minutes from the first postoperative day, passage of flatus and passage of stool, as already reported above ^{4,6,13,15-17}.

Our study aimed to verify if duration of postoperative ileus, in patients undergoing hemicolectomy for can-

cer, is related to the technique used, open or laparoscopic, or rather to the more or less extensive manipulation and exposure of the intestinal loops. This prospective study has the advantage of being conducted in a single surgical centre and in patients operated by the same operator, analysis of results is therefore not affected by the different logistic-environmental conditions and surgical skills that inevitably characterize multicenter studies.

Patients undergoing right hemicolectomy and those undergoing left hemicolectomy did not show statistically significant differences ($P < 0,01$) in the length of time for resolution of postoperative ileus.

Time resolution of POI in patients undergoing open technique with minimal manipulation (GROUP B) and in those undergoing laparoscopic technique (GROUP C) is almost superimposable. In particular non statistically significant difference ($P < 0,01$) between times of reappearance of bowel sounds, passage of flatus and passage of stool of two groups was found.

On the contrary the timing of recovery of bowel sounds, passage of flatus and passage of stool did show a statistically significant difference ($P < 0,01$) between the group treated with extensive manipulation (GROUP A) and the group treated with laparoscopic technique (GROUP C). Our data agree with those reported in literature^{4,5,18,19}, confirming an early resolution of the postoperative ileus in patients treated with laparoscopic technique compared with those treated with open technique with exposure of the intestinal loops.

As a consequence to early resolution of postoperative ileus, in GROUP B and in GROUP C return to oral intake occurred earlier than in GROUP A, with reduction of hospital stay.

The results reveal that the time of resolution of POI in patients treated with open technique with minimal manipulation and in those treated with laparoscopic techniques are nearly superimposable. Moreover, with these techniques, the recovery of intestinal motility is early compared to open technique with extensive manipulation.

Statistical analysis identified the operative technique as a factor that had influence on the time of return of bowel function; the interval to oral intake was also affected by the operative technique.

Several factors could contribute to the longer duration of the postoperative ileus in patients treated with open technique and extensive and manipulation of intestinal loops such as inhibitory reflexes evoked by intestinal loops manipulation with inflammatory cells accumulation and vasoactive hormones release.^{2,11,20,21,22} Moreover exposure of the intestinal loops outside abdominal cavity could cause a transient mesenteric-portal venous stasis which would result in a slowing of bowel movements, as reported by Picardi et al.²³

Conclusions

Resolution of POI in patients undergoing hemicolectomy for cancer is a very important prognostic index of postoperative course and allows the patient to return to oral intake with all the benefits associated.

It would appear that early resolution of POI is dependent upon minimal exposure of intestinal loops outside abdominal cavity and their minimal manipulation. These factors are not exclusive of the laparoscopic technique. In conclusion, for the surgical treatment of colon cancer, in patients with contraindication to the laparoscopic technique the open technique without manipulation and exposure of the intestinal loops is a valid alternative. In fact this technique obtains results, in terms of resolution of postoperative ileus, similar in those of the laparoscopic technique.

Riassunto

L'inibizione della motilità intestinale è un problema che si riscontra frequentemente nel decorso postoperatorio di pazienti sottoposti a chirurgia addominale. Questa condizione, definita ileo postoperatorio, ha una patogenesi multifattoriale e diversi studi hanno dimostrato una sua precoce risoluzione nei pazienti sottoposti a chirurgia laparoscopica rispetto a quelli trattati con tecnica open.

Il nostro studio ha analizzato la durata dell'ileo postoperatorio nei pazienti sottoposti ad emicolectomia per cancro e trattati con tre differenti approcci chirurgici: laparoscopia, chirurgia open con esposizione della matassa intestinale al di fuori della cavità addominale durante l'intervento e chirurgia open con mantenimento della matassa intestinale in cavità addominale; in quest'ultimo caso le anse intestinali sono state posizionate, durante l'intervento, in ipocondrio destro o sinistro e coperte con una garza laparotomia calda e umida.

I pazienti sono stati randomizzati in tre gruppi, confrontabili per quanto riguarda età, sesso, stadio della neoplasia, rischio anestesilogico.

Nel primo gruppo (GRUPPO A) 27 pazienti sono stati sottoposti ad emicolectomia con tecnica open con esposizione delle anse intestinali (n°11 emicolectomia destra e n°16 emicolectomia sinistra). Nel secondo gruppo (GRUPPO B) 28 pazienti sono stati sottoposti ad emicolectomia con tecnica open senza esposizione delle anse intestinali (n°13 emicolectomia destra e n°15 emicolectomia sinistra). Nel terzo gruppo (GRUPPO C) 26 pazienti sono stati sottoposti ad emicolectomia con tecnica laparoscopica (n°10 emicolectomia destra e n°16 emicolectomia sinistra).

Il recupero della funzionalità intestinale è stato documentato attraverso la registrazione di tre parametri: ripresa del rumore peristaltico, rilevata tramite auscultazione dell'addome, canalizzazione ai gas e canalizzazione alle feci. La ripresa dei rumori peristaltici è avvenuta mediamente dopo 2,18 giorni nel GRUPPO A, dopo 1,35 giorni

nel GRUPPO B e dopo 1,19 giorni nel GRUPPO C. La canalizzazione ai gas si è avuta mediamente dopo 3,51 giorni nel GRUPPO A, dopo 2,53 giorni nel GRUPPO B e dopo 2,30 giorni nel GRUPPO C. La canalizzazione alle feci si è avuta dopo 4,48 giorni nel GRUPPO A, dopo 3,75 giorni nel GRUPPO B e dopo 3,61 giorni nel GRUPPO C. L'analisi statistica condotta ha dimostrato una differenza significativa tra i risultati ottenuti nel GRUPPO A e nel GRUPPO B e tra quelli ottenuti nel GRUPPO A e nel GRUPPO C; al contrario non è stata rilevata una differenza statisticamente significativa tra i risultati ottenuti nel GRUPPO B e nel GRUPPO C.

Nei pazienti sottoposti ad emicolectomia per cancro, quindi la tecnica open senza esposizione delle anse intestinali e la tecnica laparoscopica ottengono risultati simili per quanto riguarda la durata dell'ileo postoperatorio.

References

1. Story S, Chamberlain R: *A comprehensive review of evidence-based strategies to prevent and treat postoperative ileus*. Dig Surg, 2009; 26:265-75.
2. Augestad K, Delaney C: *Postoperative ileus: Impact of pharmacological treatment, laparoscopic surgery and enhanced recovery pathways*. World Jour of Gastroenterology, 2010; 16(17):2067-74.
3. Holte K, Kehlet H: *Postoperative ileus: A preventable event*. Br J Surg, 2000; 87:1480-493.
4. Schwenk W, Böhm B, Haase O, Junghans T, Müller Jm: *Laparoscopic versus conventional colorectal resection: A prospective randomized study of postoperative ileus and early postoperative feeding*. Arch Surg, 1998; 383:49-55.
5. Salimath, Jones, Hunt, Lane: *Comparison of return of bowel function and length of stay in patients undergoing laparoscopic versus open colectomy*. JSLS, 2007; 11(1):72-75.
6. Reissman P, Teoh T, Cohen S, Weiss E, Noguera J, Wexner S: *Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial*. Ann Surg, 1995; 222:73-77.
7. Witte C, Witte M: *Ileus and ignorance*. West J Med, 1993; 158(5):532-34.
8. Delaney CO, Kehlet H, Senagore AJ, Bauer Aj., Beart R, Billingham R, Coleman R.L, Dozois EJ, Leslie JB, Marks J, Megibow AJ, Michelassi F, Steinbrook RA: *Clinical Consensus Update in General Surgery: Postoperative Ileus: Profiles, Risk Factors, and Definitions-A Framework for Optimizing Surgical Outcomes in Patients Undergoing Major Abdominal and Colorectal Surgery*. Clinical Consensus Update in General Surgery [Consensus statement], 2006
9. Luckey A, Livingston E, Tachè I: *Mechanisms and treatment of postoperative ileus*. Arch Surg, 2003; 138:206-14.
10. Kalff J, Türler A, Schwarz N, Schraut W, Lee K, Tweardy D, et al: *Intra-Abdominal activation of a local inflammatory response within the human muscularis externa during laparotomy*. Ann Surg, 2003; 237(3):301-315.
11. Schwarz N.T, Beer-Stolz D, Simmons R.L, et al: *Pathogenesis of paralytic ileus: intestinal manipulation opens a transient pathway between the intestinal lumen and the leukocytic infiltrate of the jejunal muscularis*. Ann Surg, 2002; 235: 31-40.
12. Ak a O, Doufas G, Sessler D: *Use of selective opiate receptor inhibitors to prevent postoperative ileus*. Min Anesthesiol, 2002; 68: 162-165.
13. Fleshman Jw, Fry Rd, Birnbaum Eh, Kodner I.: *Laparoscopic-assisted and mini laparotomy approaches to colorectal diseases are similar in early outcome*. Dis Colon Rectum, 1996; 39:15-22.
14. Kreis M.E, Kasperek M, Zittel T.T, Becker H.D, Jehle Ec: *Neostigmine increases postoperative colonic motility in patients undergoing colorectal surgery*. Surgery, 2001; 130:449-56.
15. Kasperek M, Glatzle J, Mueller M, Vogt A, Koenigsrainer A, Zittel T, Kreis M: *Postoperative colonic motility after tropisetron and a standardized meal in patients undergoing conventional colorectal surgery*. Int J Colorectal Dis, 2007; 22:521-29.
16. Ramacciato G, D'angelo F, Aurello P, Nigri G, Valabrega S, Pezzoli F, Ravaioli M, Cescon M, Cucchetti A, Lauro A, Del Gaudio M, Ercolani G: *Emicolectomia destra per cancro del colon: studio prospettico randomizzato tra tecnica laparoscopica e laparotomica*. Chir It, 2008; 60:1-7.
17. Basse, Jakobsen, Bardram, Billesbolle, Luna, Mogensen, Rosenberg, Kehlet: *Functional recovery after open versus laparoscopic colonic resection: A randomized, blinded study*. Ann Surg, 2005; 241: 416-23.
18. Neri V, Ambrosi A, Fersini A, Valentino Tp: *Right colectomy for cancer: validity of laparoscopic approach*. Ann Ital Chir, 2004; 75 (6):649-54.
19. Bianchi P, Ceriani C, Montorsi M: *La chirurgia laparoscopica nel tumore del colon. Stato dell'arte e revisione della letteratura*. Ann Ital Chir, 2004; (77)4:289-94 .
20. Behm B, Stollman N: *Postoperative ileus: etiologies and interventions*. Clin Gastroenterol Hepatol, 2003; 1:71-80.
21. Holte K, Kehlet H: *Prevention of postoperative ileus*. Minerva Anesthesiol, 2002; 68:152-56.
22. Kalff Jc, Schraut Wh, Simmons RI: *Surgical manipulation of the gut elicits an intestinal muscularis inflammatory response resulting in postsurgical ileus*. Ann Surg, 1998; 228: 31-34.
23. Picardi N, Sigismondi G, Di Paolo S, Vene M, Visini R: *Identificazione di un parametro obiettivo di riferimento per la ricostruzione secondo criteri fisiologici del grande laparocoele*. Ann Ital Chir, 2005; 76(1): 31-38.