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Colectomy, open or laparoscopic: preliminary results

Koloktomi açık ve laparoskopi: ilk sonuçlarımız

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Amaç: Laparoskopik cerrahide kullanılan aletlerin çoğunu ithal eden ülkelerde yüksek maliyetler laparoskopinin kolorektal cerrahide kullanımını kısıtlamaktadır. Bu çalışma yeniden kullanılan aletlerle yapılmış laparoskopik kolektomilerin açık teknikle erken dönem sonuçları ve maliyet analizi açısından karşılaştırılmasının yapıldığı olgu-kontrol çalışmasıdır.
Yöntem: Kasım 1999 ve Aralık 2001 tarihleri arasında 17 laparoskopik kolon rezeksiyonu uygulandı. Yaş, cins, preoperatif ASA skoru ve lezyonun histopatolojisi açısından uygun, aynı zaman aralığında açık kolon rezeksiyonu geçirmiş hastalardan bir kontrol grubu oluşturuldu. Bu iki grup ameliyat süresi, hastanede kalış süresi, postoperatif komplikasyonlar, çıkarılan dokulardaki lenf nodu sayıları ve maliyet analizi açısından karşılaştırıldı.
Bulgular: Ortalama hastanede kalış süresi laparoskopik grupta 7.2 ± 1.5 gün iken açık grupta 10.9 ± 2,6 gündü. Diseke edilen lenf nodu sayıları (11.3 ± 3 / 13.7 ±2.4) ve maliyet analizi (1594.9 ± 500.6 $ / 2304.4 ± 647.7) açısından laparoskopik ve açık gruplarda istatiksel olarak anlamlı farklılık saptanmadı.
Sonuç: Sonuç olarak Türkiye'de yeniden kullanılabilen aletlerle laparoskopik kolektomilerin yapılması mevcut fiyatlandırma politikalarıyla güvenli, uygun ve tasarruflu bir yöntemdir.

Anahtar sözcükler: ***Laparoskopi, kolektomi, maliyet***

Aim: In countries, which import most of the surgical equipments, high costs further restrict the use of laparoscopy in colorectal surgery. In this study, the short term results and the cost analysis of laparoscopic colectomies in which the re-usable equipment had been used was compared with the open technique, in a case-control study.
Methods: Between November 1999 and December 2001, 17 laparoscopic colon resections were performed, each laparoscopic case was matched for age, gender, pre-operative ASA score and the histopathology of the lesion with control patients undergoing the equivalent open procedure in the same period. Operation times, length of hospital stay, post-operative complications, number of lymph nodes in harvested specimens and cost analysis were compared between these two groups.
Results: Mean hospitalization period was 7.2+/-1.5 days in the laparoscopy group and 10.9 +/-2.6 days in the open group. No statistically significant differences were found in regard of dissected lymph node numbers, 11.3+/-3 vs 13.7+/-2.4 and cost analysis, 1594.9+/-500.6 US dollars vs 2304.4+/-674.7 US dollars between the laparoscopic and the open groups.
Conclusion: It is concluded, on condition that using the re-usable equipment, it is safe, feasible and cost effective to perform laparoscopic colectomies in Turkey with the current pricing policy.

Key words: ***Laparoscopy, coloctomy, cost***

As successful outcomes have been obtained in operations like cholecystectomy, appendectomy and hernia repair by the laparoscopic technique, the procedures have become accepted worldwide. The growing experience in laparoscopic surgery expanded the indications and more complicated operations were successfully done with this technique. Even, the laparoscopic colon operations have been started in the surgical treatment of not only benign but also malignant colonic diseases (1,2). With the advantages of less post-operative pain, shorter hospitalization time, early return to work and better cosmetic results, laparoscopic

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Table 1. The features of the patients in Laparoscopic (LC) and Open colectomy (OC) groups

	LC Group n=17	*OC Group n=17*
Gender (Male/Female)	6/9	6/9
Age (mean)	58	58
ASA I	7	7
ASAII	7	7
ASAIII	3	3
Length of hospital stay (day)	7.2	10.9
Total cost (US dollar)	1594	2304

Table 2. The indications and the operations in the Laparoscopic (LC) and Open colectomy (OC) groups

	LC Group n=17	*OC Group n=17*
Adenocarcinoma-Left colon	5	5
Adenocarcinoma-Right colon	4	4
Adenocarcinoma- Sigmoid	4	4
Rectal prolapsus	3	3
Constipation	1	1
Left hemicolectomy	6	6
Right hemicolectomy	4	4
Anterior resection	4	4
Ant. Resection + rectopeksia	3	3

technique in colon surgery have become an important alternative to the traditional open abdominal surgery (3). In addition, it was revealed in experimental animal models that laparoscopic colon resections alters the stress and immune system of healthy rats less than open resections (4). Another reported advantage of the laparoscopic technique is the faster post-operative recovery of the pulmonary functions compared with the conventional open surgery (5).

However, in developing countries, the high costs related to the imported laparoscopic instruments make the advantage of laparoscopic procedure over the open procedure controversial. In papers coming from western world, longer operating time looks the most important contributor to the increased cost of each operation especially in cases converted to open surgery (6). On the other hand, neither the operating room hourly prices nor the charge of surgeons are high in most developing countries. Contributing factors to cost analysis may therefore be changing among countries.

In this ongoing study we aimed to compare the short term outcomes and cost analysis between the open and the laparoscopic technique of colon surgery in a university hospital set up in Turkey, where the instruments are mostly reusable.

Materials and Methods

Between November 1999 and December 2001, 17 laparoscopic colon resections were performed, in this case-control study, each laparoscopic case was compared with control patients undergoing the equivalent open procedure in the same period matched for age, gender, pre-operative ASA score and the pathology. Operation times, length of hospital stay, post-operative complications, histopathologic results mainly the number of dissected lymph nodes and cost analysis were compared between these two groups.

For the total cost analysis, the receipts of all the equipments that were used in surgery added to the hospital expenses including preoperative blood work, hospitalization and stay in the intensive care area.

In all laparoscopic operations "laparoscopy-assisted" technique were used. There were six male and nine female patients with a mean age 58+/-11.3 (range, 30 to 74 years). The pre-operative ASA scores of all the patients were evaluated and a mean value of 1.76 +/- 0.7 was found in each group (Table 1). The primary colon diseases were malignant in 13 and benign in 4 patients in each group. As it was a case control study the indications for surgery were also similar in both groups with 4 sigmoid, 5 left colon, 4 right colon carcinomas, 3 rectal prolapsus and 1 intractable constipation (Table 2). All the open and laparoscopical operations were done by the same surgeon deliberately as uniform as possible. The mean post-operative patient follow-up periods were 12.2+/-8.5 months in the laparoscopic and 14.7+/-7.6 months in the open surgery groups. The patients with malignant diseases were examined in every 3 months and then on every 6 months until 3 years with physical examination, tumor markers, colonoscopy and computerized tomography against the probability of local or systemic recurrences.

Student's t test was used for the statistical analysis and differences were assumed to be significant if the resulting p value was less than 0.05.

Results

The mean operation time was 178+/-43 hours in the laparoscopy group and 112+/-28 hours in the open surgical group ($p<0.05$). Blood transfusions were not required

in either groups during or after surgery. There was only one conversion to the open surgery in the laparoscopy group due to adhesions and ureteral exposure problem in a female patient who had a myomectomy operation previously. Therefore, the conversion rate was 5.5% in our series.

Mean hospitalization period was 7.2+/-1.5 days in the laparoscopy group (range, 5-10 days) and 10.9+/-2.6 days in the open group (range, 8-16 days) ($p<0.05$).

In both groups, an intravenous line was inserted for the post-operative patient control analgesia with Meperidine. There was no post-operative mortality. As a morbidity, one urinary tract and one wound infection were observed in the laparoscopy group. In the open surgery group, there were 3 surgical wound infections and in one patient, atelectasia was found to be the reason of the post-operative fever which resolved uneventfully.

The cost analysis was calculated as US dollars using the daily rate of exchanges and the mean cost was found to be 1594.9+/-500.6 USD (range, 777-2643 USD) in the laparoscopy group whereas it was 2304.4+/-674.7 USD (range, 1079-3054 USD) in the open surgery group ($p>0.05$).

Regarding to the histopathologic examination of the surgical specimen, the mean number of dissected lymph nodes of the mesocolon was 11.3+/-3 (range, 6-18) in the laparoscopy and 13.7+/-2.4 (range, 10-18) in the open surgery groups ($p>0.05$).

During the follow-up period no local or systemic recurrences were detected in patients with malignant diseases.

Discussion

In 1991, Cooperman had reported the first laparoscopic right hemicolectomy and in the same year the first laparoscopic sigmoid resection was also published by Fowler et al. (7,8). Afterwards, laparoscopic approaches in both benign and malignant colon diseases have begun to appear in the literature (1,2,9). With the increasing experience and patient numbers, recent studies have revealed that laparoscopic colectomy is a safe alternative with low operative conversion, morbidity and mortality rates (10).

Although, the laparoscopic cholecystectomy, inguinal hernia repair, appandectomy and hiatus hernia operations are routinely done in many centers, the experience in laparoscopic colon surgery is very limited in Turkey. As a restricting factor, the high costs of the imported laparoscopic special equipments play a major role besides the need of distinctive training and experience.

The costs of a laparoscopic colon resection reaches extremely high amounts by using the disposable single-use equipments, however the cost should be lowered with preferring the reusable ones. Nevertheless, the shorter hospital stay, less need of additional therapies in related to the lower morbidity rates may reduce the cost in laparoscopic technique's favors. The results of our study have supported this hypothesis and although the difference was statistically insignificant, the cost was found to be lower in the laparoscopic ally treated group but it should be emphasized that higher operation times do not alter the total cost of the procedure as the operating room prices are not taken into account on a hourly basis in our country.

The cost analysis was done very attentively to include all the drug and equipment prescriptions related to the operation in the pre and post-operative period.

In most of the reported clinical studies, the morbidity rates are similar between laparoscopic and open colon surgery (10) but in few, higher complication rates have also been notified (11). Denying the possible role of experience and special training of the colorectal surgeons on complication rates is unnecessary. The complications should be prevented or minimized by allowing these particular operations to be done by the surgeons, experienced in both colorectal and laparoscopic surgeries. In our series, as a result of the higher wound infection rate in the open surgery group, the post-operative morbidity seems to be lower in patients with laparoscopic approach. Anastomotic leakage or intra-abdominal abscess had revealed in neither groups.

The open conversion rate of the laparoscopic colon surgery is between 10-25% in the literature. In a recent prospective non-randomized study, 150 laparoscopic colon surgeries were compared with 160 open abdominal colon resections with a 8.6% overall conversion rate and it was determined that the rate was fall down to 4% in the latter 50 operations from 19.3% which was encountered in the first 30, emphasizing the importance of experience (10).

Mostly, the conversions are raised from hemorrhage, defective anastomosis, adhesions, the mobilization problems of splenic flexure or the rectum and obesity. In our series, the only conversion (5.5%) was done as a result of a exposure problem in a previously myomectomized patient.

The suspicion of inappropriate oncologic surgery remained the major controversial issue for many years, regarding to the laparoscopic colon surgery especially in malign diseases. However, in clinical studies comparing the open and the laparoscopic technique, no statistically significant oncologic follow-up difference was found (10,12,13). We also observed that the number of dissected mesocolonic lymph nodes and the tumoral distance to the resection lines were similar in both groups. Although we have not encountered any local recurrence or systemic metastasis, the follow-up period is not long enough for making a comment but it should be emphasized that

the oncologic surgical criteria that must be applied for a curative resection of a malignant disease, such as, wide resection, no manipulation of the tumor, radical lymph node dissection and proximal ligation of the mesenteric vessels are also applicable by the laparoscopic technique. A similar outcome expectation in the long term follow-up sounds logical even for the malign diseases when the operation is done with an appropriate laparoscopic approach.

As a conclusion, even in developing countries by stipulating the reusable instruments, laparoscopic colon surgery is an important alternative for not only benign but also for malign diseases with lower cost, shorter hospital stay and less infection rates.

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