

# Laparoscopy Assisted Appendectomy in Adult Patients: The Two Trocar Technique

## Yetişkin Hastalarda Laparoskopik Yardımlı Apendektomi: Çift Trokar Tekniği

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### ABSTRACT

### ÖZ

**Introduction:** Acute appendicitis is the most common surgical emergency encountered in general surgery practices. Laparoscopic appendectomy has widely replaced open conventional appendectomy, since it is associated with better surgical and aesthetic outcomes, less postoperative pain and early return to work. However, it is also associated with high costs. To combine the cost-effectiveness of conventional surgery and advantages of laparoscopic surgery, the two trocar technique has evolved and been gaining attention. In this study, we aimed to present the results of our patients, who underwent laparoscopic assisted appendectomy in a tertiary surgery clinic.

**Material and Methods:** 42 patients, who were diagnosed with acute appendicitis and underwent laparoscopic appendectomy with two trocar technique, were enrolled in this retrospective study. Their age, sex, postoperative VAS scores, perioperative complications (superficial wound infection, intraabdominal abscess, bleeding) and durations of stay were recorded.

**Results:** The mean age of patients was 32.09±9.17 years. 32 patients were male and 10 were female. The average VAS scores at 12 hours and 24 hours postoperatively were 6.26±1.17 and 3.12±0.99, respectively. All patients were discharged within 24 hours post-operation. Two patients developed surgical site infections, and one patient developed an intraabdominal abscess. No incidents of bleeding were recorded.

**Conclusion:** Two trocar technique is a safe and favorable surgical option in selected patients in treatment of acute appendicitis with high cost-efficiency.

**Keywords:** Acute appendicitis, two trocar technique, minimal invasive surgery

**Giriş:** Genel Cerrahi pratiğinde en sık görülen acil hastalık akut apandisitir. Daha iyi cerrahi ve estetik sonuçlara sahip olması, daha az postoperatif ağrı ve iş gücü kaybıyla ilişkili olması nedeni ile laparoskopik yöntem geleneksel açık yöntemin yerini almıştır. Ancak bu yöntem yüksek maliyet ile de ilişkilidir. Geleneksel açık cerrahinin maliyet etkinliği ile laparoskopik cerrahinin avantajlarını bir arada elde edebilmek amacı ile çift trokar tekniği geliştirilmiştir. Biz de bu çalışmamızda üçüncü basamak cerrahi kliniklerinde bu yöntem ile laparoskopik apendektomi operasyonu geçiren hastaların sonuçlarını paylaşmayı amaçladık.

**Materyal ve Metotlar:** Çalışmaya 42 hasta dahil edildi. Yaş, cinsiyet, postoperatif VAS skorları, peroperatif komplikasyonlar (yüzeysel yara yeri enfeksiyonu, intraabdominal apse, kanama) ve hastanede kalış süreleri kaydedilerek incelendi.

**Bulgular:** Hastaların yaş ortalaması 32,09±9,17 olarak bulundu. Cinsiyet dağılımında 32 hasta erkek 10 hasta kadın idi. Postoperatif 12. ve 24. saatte ortalama VAS skorları sırasıyla 6,26±1,17 ve 3,12±0,99 olarak bulundu. Tüm hastalar postoperatif 24. saatte taburcu edildi. Takiplerinde iki hastada yüzeysel yara yeri enfeksiyonu ve 1 hastada karın içi apse gelişti. Herhangi bir hastada peroperatif kanama olmadı.

**Sonuç:** Çift trokar tekniği akut apandisit tanısı ile acil opere edilecek seçilmiş hastalarda yüksek maliyet etkinliği nedeni ile tercih edilebilir ve güvenli bir yöntemdir.

**Anahtar Sözcükler:** Akut apandisit, çift trokar tekniği, yüksek maliyet etkinliği

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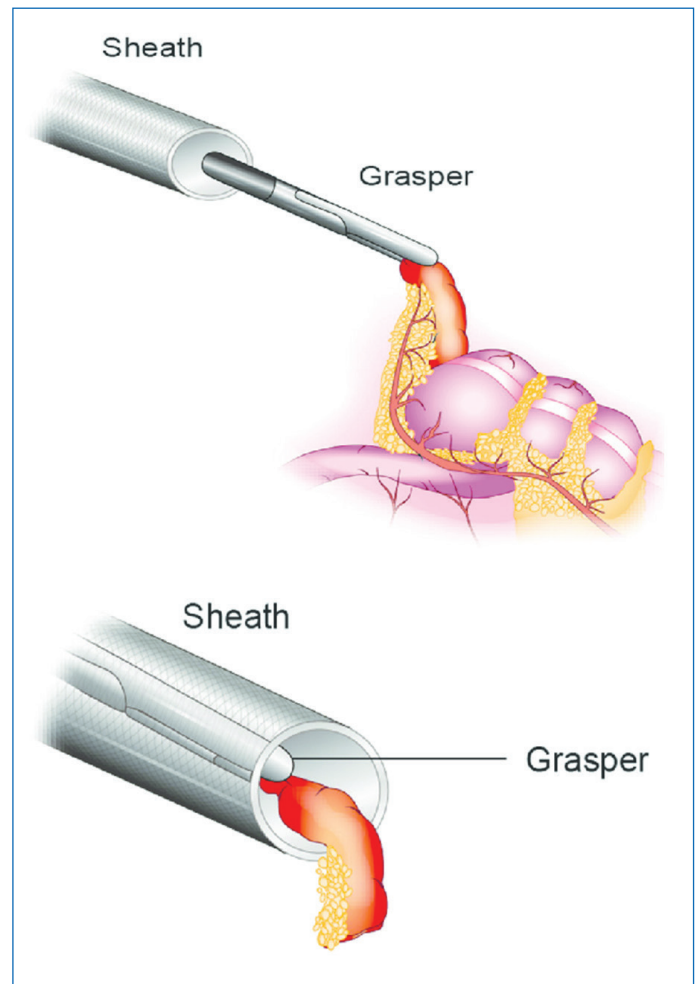
## Introduction

Acute appendicitis is the most common surgical emergency in general surgery practice (1). In 1889, McBurney published the first appendectomy case series, and since then, the McBurney incision has been used as a standard procedure as part of conventional surgery (2). However, laparoscopy has gained popularity since the 1980s and has replaced conventional open surgery in the majority of clinics (3, 4). It is widely known that laparoscopic appendectomy has certain advantages, such as shorter length of hospital stays (LoHS), better aesthetic outcomes, and lower complication rates. However, despite its worldwide use, it is still associated with higher costs (5, 6). To address this issue, the two-trocar technique was introduced as a method to combine the cost-effectiveness of conventional surgery with the benefits of laparoscopic surgery (7, 8). This study aimed to demonstrate the efficacy and safety of laparoscopy-assisted two-trocar appendectomy based on data obtained from 42 selected patients operated on at our surgery clinic.

## Material and Methods

A total of 42 patients, whose clinical and radiological signs were indicative for acute appendicitis (nausea, loss of appetite, vomiting, abdominal pain (especially right lower quadrant), positive computed tomography (CT) or ultrasonography (US) findings and increased white blood cell (WBC) counts) and who subsequently underwent laparoscopic appendectomy with 2-trocar technique between December.2019 and March.2023 were enrolled in this retrospective study. This number of patients represented merely the total number of cases rather than a specific predesignation. Ethical approval was obtained from the local ethics committee (B.10.1.TKH.4.34.H.GP.0.01/522). Patients with generalized peritonitis signs and/or patients with perforated appendicitis signs, such as periappendicular abscess, patients with a prior open abdominal surgical history and patients with a body mass index greater than 30 were excluded. Patients' demographic data (age, sex), perioperative and postoperative complications (bleeding, abscess formation, superficial wound infections), visual analogue scale (VAS) scores (a patient oriented scoring system for pain evaluation, by which 1 represents the lowest pain score and 10 represents the highest pain score) at postoperative 12 hours and 24 hours, duration of stays were recorded and evaluated. The available data were presented in mean  $\pm$  standard deviation.

Patients were operated under general anesthesia. 1 g IV cefazolin and 0,5 g IV ornidazole were administered before incision as prophylaxis. Both surgeon and assistant were positioned on the left side of patient, while the surgical nurse and camera were positioned on the right side. A 10 mm incision was made just under the umbilicus and a veress needle was inserted into the abdomen. Then the abdomen was insufflated with CO<sub>2</sub> and the pressure was stabilized at 10-12 mmHg. Following that, an infraumbilical 10 mm trocar was



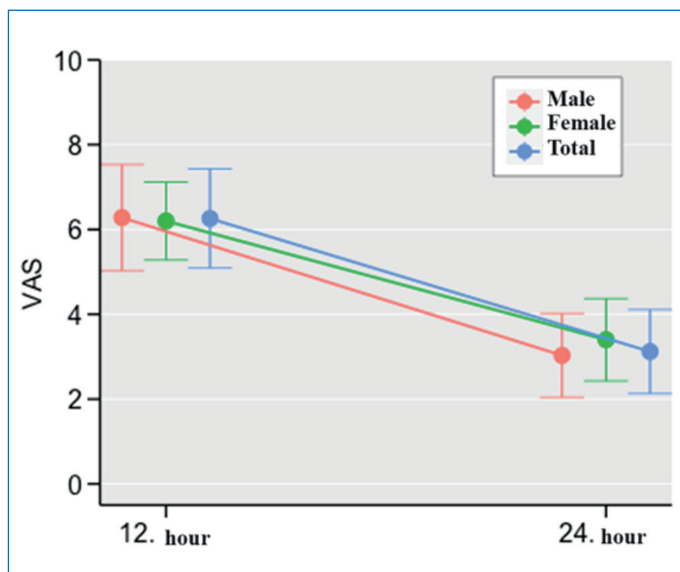
**Figure 1.** Grasping and Pulling of The Appendix Vermiformis Through 15 mm Trocar

inserted and abdominal exploration was undertaken with a 30 degree angled laparoscope. Then the patient was positioned in 30 degree Trendelenburg and 15 degree left lateral tilt. A 15 mm trocar was inserted at McBurney point under direct visualisation, since this location provides the shortest distance between caecum and abdominal wall and in case of a necessity for conversion to open surgery, a cranially extended incision from this point usually suffices. Appendix vermiformis was pulled into the 15 mm trocar with a grasper and when the radix of appendix was close enough to abdominal wall, the appendix was pulled out along with the trocar (Figure 1). Subsequently, the abdomen was desufflated. The trocar site was prepped with povidone iodine, while the appendix was inside the trocar entry line, to reduce contamination. The resection was performed just like a usual conventional open appendectomy. Following resection and gentle relocation of radix into the abdomen, a last visualisation with the laparoscope was performed, to make sure there was no adverse events, such as bleeding etc. After removing the trocars, local anesthetic was injected at trocar entry sites. Both fascial defects were closed with nonabsorbable sutures.

**Table 1.** Demographic Findings

	Total (n = 42)	Sex	
		Male (n=32)	Female (n=10)
Age (year)	32,9 ± 9,17	33,46 ± 9,35	27,7 ± 7,36
12-hour VAS	6,26 ± 1,17	6,28 ± 1,25	6,2 ± 0,92
24-hour VAS	3,12 ± 0,99	3,03 ± 0,99	3,4 ± 0,97

Data are given as mean ± SD.  
VAS: Visual Analog Scale

**Figure 2.** VAS Score Changes

## Results

The study enrolled 42 patients diagnosed with acute appendicitis and treated with the two-trocar laparoscopic appendectomy technique. The mean age of patients was 32.09±9.17 years (Table 1). The average VAS scores at 12 hours and 24 hours postoperatively were 6.26±1.17 and 3.12±0.99, respectively (Figure 2). All patients were discharged within 24 hours post-operation. Two patients developed superficial wound infection (SWI), and one patient developed an intraabdominal abscess (Table 2). No incidents of bleeding were recorded.

**Table 2.** Peroperative Complications

	n
Bleeding	0
Superficial Wound Infection	2 (4,7%)
Intraabdominal Abscess	1 (2,3%)

Data are presented as n (%).

## Discussion

Laparoscopic appendectomy was defined in 1983. However, its popularity did not increase as swiftly as of laparoscopic cholecystectomy, which was defined 4 years after. The underlying reasons can be suggested as follows; open conventional surgery also required a small incision, high costs and difficulty in arrangement of laparoscopic devices in emergency setting (9,10).

The most common difficulties with open appendectomy are surgical site infections, postoperative adhesions, incisional hernia and restricted availability of intraabdominal exploration (11). With laparoscopic appendectomy, the rate of the above-mentioned complications are greatly reduced and since laparoscopy allows a far greater visibility of surrounding organs and structures, a concomitant pathology or in case of a negative appendectomy, another primary pathology can easily be identified and addressed (12,13). The operative time was considerably longer than open surgery for initial procedures. However, this phenomenon changed and contemporary literature suggests even a shorter procedure compared to open conventional surgery (14).

The literature reports an average of less than 10% complication rates following laparoscopic appendectomy, which can increase up to 25%, when all minor local and systemic complications are evaluated (15,16). These rates increase twofold for open surgery. The most encountered complications of laparoscopic surgery are trocar entry site infections, intraabdominal adhesions and periappendicular abscess formation (17). The complication rates of our patients also fall under 10% threshold, which is consistent with one of the major advantages of laparoscopy.

The literature also suggests that analgesic requirement is reduced following laparoscopic appendectomy (15, 18). To reduce postoperative pain even further, trocar entry sites should be less traumatized while accessing the abdomen, intraabdominal gas and fluids should be completely evacuated at the end of the procedure and local anesthetic should be administered at the trocar entry sites (19). Reduced postoperative pain means reduced postoperative nausea, increased oral intake and mobilisation. In this study, none of the patients required a strong analgesic, such as opioids. It is also known that the time required to return to normal daily activity is shorter for laparoscopic procedures (20). In our study, patients were started oral intake and mobilized at postoperative 8 hour. Given that our patients' mild to moderate perceptual postoperative pain and the ability to be discharged 24 hours postoperatively, we believe it is safe to assume that the two trocar technique also bears the advantages of laparoscopy in this regard.

Laparoscopic appendectomy is considerably costly compared to open surgery due to required devices, such as specimen retrieval systems, endostapler and new generation energy devices (21).

To perform an appendectomy laparoscopically, a surgeon should utilize at least a few of the above-mentioned costly devices (22). However, when the two trocar technique is performed, both mesoappendix dissection and resection of the appendix can be performed similar to open surgery by utilizing similar tools. Due to currency differences and various and ever changing taxation rates of surgical devices in our country, a retrospective cost-effectiveness analysis could not be performed. We believe this reality to be the major flaw of our study. Nevertheless, the two trocar technique probably reduces costs of surgery, by mimicking a conventional surgery in terms of resection, while maintaining the advantages of laparoscopy and can be safely performed in nonobese patients without signs of perforation (22,23). Future prospective trials including cost analysis will shed more light on this issue.

In our study, no patient had a bleeding event. Only two patients showed SWI, which were successfully treated with local wound care and oral antibiotics. A patient was diagnosed with intraabdominal abscess on postoperative day 9 and hospitalized. The abscess was drained under US guidance and the patient was discharged after he was administered IV antibiotherapy for 5 consecutive days.

This study has further limitations. Its retrospective nature leads to selection bias. However, the body of evidence in literature about this topic is scarce and to our knowledge no prospective trial exists to this date. Therefore, any contributed data is of significant importance and the aim of this study was to prove the safety and efficacy of this technique in a specifically selected patient group. So, we believe that this selection bias does not propose a meaningful contradiction for this study. Besides, these data provide a base of knowledge for future prospective trials, in terms of selection criteria. Another important limitation was the modest sample size of our study, which could inevitably limit the statistical power of our study. For the above-mentioned limitations, we perceive the results of this study to be mere suggestions rather than conclusions and pave the way for future research.

In conclusion, the two-trocar technique for laparoscopic appendectomy has shown promise in delivering a cost-effective, minimally invasive option with acceptable complication rates for a specific patient demographic. While our study provides foundational insights into its application, further research is required to comprehensively assess its efficacy and cost-effectiveness. Prospective studies involving a broader patient population are essential to establish more definitive conclusions and to better inform clinical practice.

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