LESS

Original Article

Laparosc Endosc Surg Sci 2024;31(3):93-99
DOI: 10.14744/less.2024.22308

Laparoscopic versus open right hemicolectomy for colon cancer: Long-term outcomes from a Tertiary Care Teaching Hospital

Murat Yıldırım, Bülent Koca

Department of General Surgery, Tokat Gaziosmanpaşa University, Faculty of Medicine, Tokat, Türkiye

ABSTRACT

Introduction: The aim of this study was to compare the short- and long-term outcomes of laparoscopic surgery and open surgery in right colon cancer.

Materials and Methods: Demographic, clinicopathological, postoperative complications, mortality and long-term oncological outcomes of 162 patients who underwent laparoscopic (n=61) or open (n=101) surgery for colon cancer between January 2014 and December 2019 were compared in two groups.

Results: The operation time was significantly longer in the laparoscopic group (p<0.001). Length of hospital stay, tumor stage, T stage, N stage, tumor diameter and number of excised lymph nodes were significantly higher in the OS group. Postoperative morbidity and mortality rates were similar in both groups. The surgery was converted to open surgery in five patients (8.1%) in the LS group. There was no significant difference between the groups in terms of overall survival (p=0.086) and disease-free survival (p=0.089).

Conclusion: Laparoscopic and open right hemicolectomy operations had similar results in terms of short-term complications, mortality and long-term oncological findings.

Keywords: Colon cancer, Right hemicolectomy, Laparoscopy

Introduction

Colorectal cancer continues to be one of the major health-threatening diseases today. It is the third most common cancer worldwide.[1] In addition, there has been an increase in the incidence of right colon cancers in recent years. They account for approximately 40% of colon tumors.[2] Today, the laparoscopic approach has become popular, especially in the surgery of left colon and rectal cancers. The advantages of laparoscopic colectomy include less wound infection, less postoperative pain, rapid recovery, and shorter hospitalization.[3,4] Moreover, this approach is associated with similar oncological outcomes and better postoperative recovery compared to open surgery.[5] However, the situation is somewhat different for the right colon. Data are more limited in oncological right hemicolectomies. Concerns include the high learning curve due to the proximity of laparoscopic right hemicolectomy to important anatomical structures, vascular variations, the length of the operation, and the inability to remove enough lymph nodes. For these reasons, laparoscopy is less preferred, and controversy on this issue continues.[6,7]

Received: 01.09.2024 **Revision:** 11.09.2024 **Accepted:** 11.09.2024
Correspondence: Murat Yıldırım, M.D., Department of General Surgery, Tokat Gaziosmanpaşa University, Faculty of Medicine, Tokat, Türkiye
e-mail: dryildirim40@yahoo.com

The aim of the present study was to review the postoperative complications and long-term oncological outcomes of patients who underwent laparoscopic right hemicolectomy for right colon cancer and to compare them with open surgery.

Materials and Methods

Between January 2014 and December 2019, right hemicolectomy surgeries performed for colon cancer in the oncological surgery clinic of Tokat Gaziosmanpasa University Training and Research Center were retrospectively analyzed from the prospective database. Due to the retrospective design of the study, ethical approval and informed consent were not required. However, the study was conducted in accordance with the Ethical Principles of the Helsinki Declaration. Patients with distant metastases, immunosuppressive conditions, patients who underwent emergency surgery due to obstruction and/or perforation, and patients under 18 years of age were excluded from the study.

Patients diagnosed with colon cancer, whose diagnosis was preoperatively confirmed histopathologically as adenocarcinoma, were included. The patients were staged preoperatively with multi-slice abdominal and thoracic CT. PET/CT was used in necessary cases. The decision to perform the operation was made by the multidisciplinary tumor council, which convenes weekly in our clinic. The surgeries were performed by senior colorectal surgeons. The surgical procedure included both open and laparoscopic D2 lymphadenectomy and the standard right hemicolectomy procedure.

Demographic data (age, gender), American Society of Anesthesiologists (ASA) status, preoperative body mass index (BMI), tumor localization, tumor staging, number of excised reactive and metastatic lymph nodes, duration of surgery, intraoperative and postoperative complications, time to start oral feeding, duration of postoperative hospital and intensive care unit stays, relapse status, survival, and oncological follow-up data were analyzed. Postoperative complications were defined as surgical and non-surgical complications occurring from the postoperative period until discharge. Mortality was defined as death within 30 days from the date of surgery.

Recurrence was defined as the appearance of new lesions in the anastomosis and/or surrounding colon wall and/or in the lymphatic drainage zone of the previously resected tumor, confirmed by clinical findings, scanning tomography, positron emission tomography-CT (PET-CT), or pathological examination. Recurrence of the disease in the peritoneum or other organs was considered distant metastasis.

Statistical Analyses

Statistical analyses of the data obtained in this study were performed using SPSS software (Version 22, SPSS Inc., Chicago, IL, USA). Continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test. The Chi-square test was used in the analysis of categorical variables. The survival rate was analyzed using the Kaplan-Meier method, and the groups were compared with the log-rank test. A p-value of <0.05 was considered statistically significant.

Results

The study cohort consisted of a total of 162 patients. There were 61 patients in the laparoscopic surgery (LS) group and 101 patients in the open surgery (OS) group. Demographic and clinicopathological data are presented in Table 1. The mean age was 68.28±12.3 years across all groups. The mean age in the LS group (32 females and 29 males) was 69.3±11.4 years, while the mean age in the OS group (50 females and 51 males) was 67±12.8 years. There was no significant difference between the groups in terms of age or gender ($p>0.05$). According to the ASA classification, comorbidities were similar in the two groups. There was no difference between the groups in terms of cancer localization, BMI, or the number of metastatic lymph nodes ($p>0.01$).

Tumor diameter and lymph node count were significantly higher in the OS group ($p<0.001$ and $p=0.035$, respectively). Average tumor stage was significantly more advanced in the OS group's T and N stages ($p=0.03$, $p=0.01$, and $p=0.003$, respectively).

A total of five patients (8.1%) in the LS group underwent open surgery. Two patients had extensive adhesions due to previous open cholecystectomy and prostate operations. Conversion took place due to ureteral injury in one patient, bleeding in one patient, and duodenum invasion of the tumor in another patient.

Preoperative, intraoperative, and postoperative data are presented in Table 2. There was no significant difference between the LS and OS groups in terms of time to liquid

Table 1. Demographic and clinicopathological data

	LS (n=61)	OS (n=101)	p
Age (years) (mean±SD)	69.3±11.4	67±12.8	0.39
Gender (n,%)			
Female	32 (52.4)	50 (49.5)	0.71
Male	29 (47.5)	51 (50.4)	
BMI(mean±SD)	27±5.6	28.5±6.3	0.09
ASA(n)			0.26
1	2	0	
2	14	10	
3	34	62	
4	11	29	
Location of cancer, (n,%)			
Caecum	32 (52.4)	52 (51.4)	0.18
Ascending colon	16 (26.2)	38 (37.6)	
Transverse colon	13 (21.3)	11 (10.8)	
Stage(n)			
1	15	10	0.032*
2	21	35	
3	25	56	
T Stage(n)			0.019*
1	4	5	
2	23	34	
3	23	73	
N Stage(n)			0.003*
0	37	42	
1	16	21	
2	8	38	
Tumor diameter (mean±SD)	3.8±1.8	5.6±2.9	<0.001*
Number of lymph nodes (mean±SD)	16.8±6.4	20.7±9.4	0.035*
Number of metastatic lymph nodes (mean±SD)	2.9±3.2	3.4±3.9	0.353
Conversion (n, %)	5 (8.1)	-	

*Significant.

diet initiation (3.0 and 3.4 days, respectively, p=0.18). The mean operative time for LS was significantly longer than for OS (156 minutes vs. 113 minutes, respectively, p<0.001). The length of hospital stay was longer in the OS group (9.2 vs. 6.5 days, respectively, p<0.001).

Overall, there was no significant difference between the two groups for intraoperative and postoperative complications. Anastomotic leakage was observed in three patients (2.9%) in the OS group and in two patients (3.2%) in the LS group. Wound site infection was more common in the OS group (six patients vs. one patient). The distribution of complications is given in Table 2.

In terms of 30-day mortality, one patient in the LS group and three patients in the OS group died after surgery. All deaths in the OS group were due to underlying medical comorbidities. The patient in the LS group, on the other hand, was re-operated on twice for postoperative anastomotic leakage but died due to sepsis.

Survival

The Kaplan-Meier curves comparing the overall and disease-free survival rates in the two groups are presented in Figures 1 and 2. There was no significant difference between the two groups in terms of overall survival

Table 2. Preoperative, intraoperative and postoperative data of the patients

	LS (n=61)	OS (n=101)	p
Mean operating time (min)	156±45	113±50.7	<0.001*
Duration of hospitalization (day) (mean±SD)	6.5+3.7	9.2+4.8	<0.001*
ICU length of stay (day) (mean±SD)	4.2±8.7	2.7±4.5	0.16
liquid diet (day) (mean±SD)	3±1.6	3.4±1.9	0.185
Intraoperative complication (n)			
Bleeding	2	3	-
Organ wounding	1	1	
Other	1	2	
Postoperative Complication(n,%)	6 (9.8%)	14 (13.8%)	0.252
Anastomotic leakage	2	3	
Anastomotic bleeding	1	0	
Intra-abdominal sepsis	1	2	
Ileus	3	5	
Wound complications	1	6	
Chylous ascites	1	1	
Incisional hernia	-	1	
Pulmonary	3	1	
Cardiac	1	-	
Other	-	-	
Reoperation (30-day) (n,%)	2 (3.2)	3 (2.9)	-
Mortality (n,%)	1 (1.6)	3 (2.9)	0.26

*Significant; ICU:Intensive care unit.

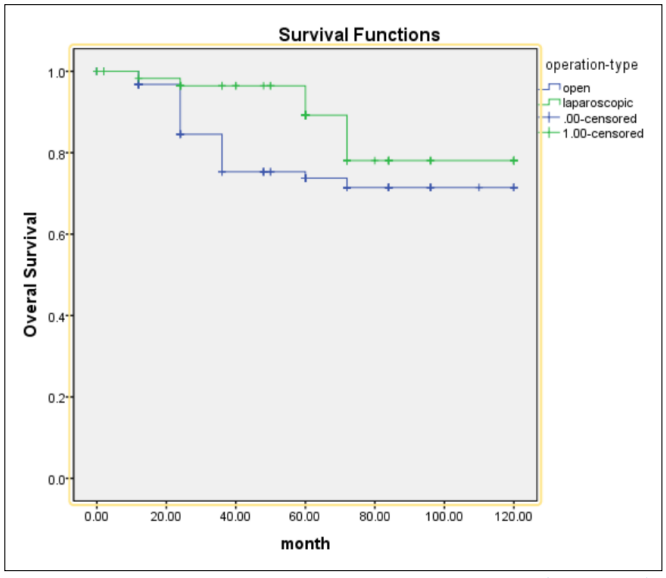

Figure 1. Overall survival in the study groups (p=0.086).

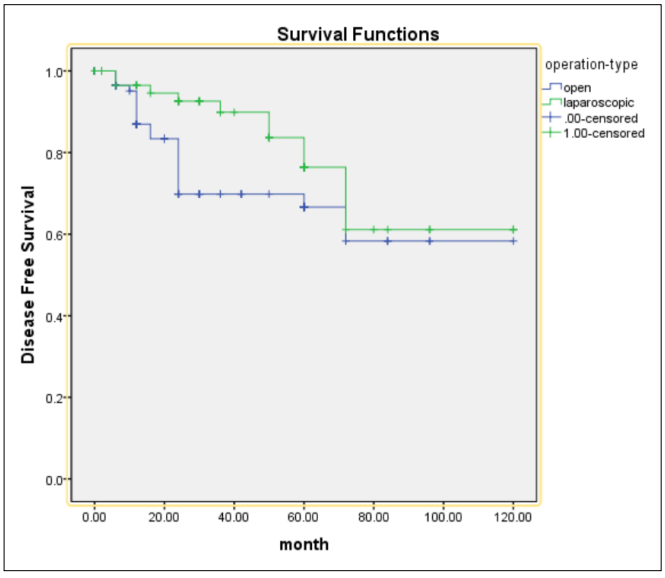

Figure 2. Disease-free survival in the study groups (p=0.089).

(p=0.086) and disease-free survival (p=0.089). The five-year overall survival in the OS and LS groups was 71.5% and 73%, respectively, while the five-year disease-free survival was 66.6% and 65.5%, respectively. There were two loco-regional cases in the LS group, and no systemic recurrence was detected. In the OS group, there were three loco-regional and three systemic recurrences.

Discussion

In 1991, Jacobs et al.[8] described laparoscopic colectomy, and since then, there has been rapid progress in laparoscopic colon surgery. Many colorectal procedures can now be performed with laparoscopy. The safety of the laparoscopic approach for short- and long-term oncological outcomes, especially in left colon and rectal cancer surgery, has been demonstrated in many studies.[9,10] However, there is still debate about whether laparoscopic colectomy has advantages over open surgery in terms of short- and long-term outcomes for right-sided colon cancers.[11,12]

In the present study, there was no significant difference between patients who underwent laparoscopy or open surgery for demographic data and comorbidities. The results were consistent with previous studies.[13] However, unlike previous studies [13,14], open surgery was used more frequently as tumor size increased in the present study. T stage and N stage were significantly higher in the open group. In larger tumors, open surgery may be preferred due to oncological safety concerns and lack of experience, especially in early cases.

Additionally, the total number of lymph nodes excised in our study was significantly higher in the open group (mean: 16 in the LS group, 20 in the OS group, p = 0.035). Some patients in the laparoscopic group had fewer than 12 lymph nodes removed, which was inconsistent with previous studies.[14,15] However, debate on this issue continues in the literature. A meta-analysis of 27 studies involving 3,049 patients reported no difference in the number of lymph nodes removed by laparoscopy and laparotomy.[12] On the other hand, Jurowich et al.[16] conducted a study using propensity score analysis of data from nearly 5,000 patients in the DGAV StuDoQ|Colon Cancer registry and found that significantly fewer lymph nodes were removed in the laparoscopic group. In their study, the probability of excising ≥20 lymph nodes was significantly higher in the open surgery group (OR: 3.45, CI 95%: 2.22–5.26; p<0.0001).

The mean operation time was significantly longer in laparoscopic surgeries, while the length of hospital stay was longer in the open surgery group. This was comparable to previous studies.[17,18] We attributed this to the long learning curve and the anatomical variations in the laparoscopic group. In the present study, we noted that the first laparoscopic surgeries took longer, but the duration of the operation decreased as experience increased. Stergios et al.[19] reported that the operation time was significantly reduced in the laparoscopic group compared to the open surgery group as the surgical team gained more experience in laparoscopic techniques.

Our conversion rate of 8.1% was comparable to the 0-16% conversion rates reported in previous studies.[13,17,20–22] Although the overall complication rate was slightly higher in the open group than in the laparoscopic group, the difference was not significant. Different results have been presented in the literature on this subject. In the Arezzo et al.[12] study, the incidence of overall complications was significantly lower in the laparoscopic group (16.8%) compared to the open group (24.2%). Rausa et al.[23] reported a higher overall complication rate in patients who underwent open right hemicolectomy. On the other hand, Jurowich et al.[16] found no difference between the two approaches for postoperative complications. Likewise, Li et al.[24] reported that there was no significant difference in postoperative complication frequency between the laparoscopy and open right hemicolectomy groups.

In our study, although the 30-day mortality rates were lower in the laparoscopic group (1 patient vs. 3 patients), there was no significant difference between the groups. This finding contradicts a recent large case series from the Netherlands[25], which reported that 30-day mortality rates were significantly lower in the laparoscopic group (2.2% vs 3.6%, p<0.001). In contrast, Arezzo et al.[12] reported in their meta-analysis that there was no significant difference between the laparoscopy and open surgery groups (RR=0.53, 95% CI=0.13–2.11, p=0.37). Mortality rates in the study by Ding et al.[26] were also similar to the results of the present study.

Considering long-term oncological outcomes, there was no significant difference between the two groups for five-year OS and DFS. Undoubtedly, the number of patients included in this study was low for comparing oncological outcomes. Furthermore, the retrospective nature of the study may have affected the results. To make a more reliable comparison between the two groups, larger sample sizes and randomized prospective studies are needed. However, based on our findings, it can be stated that the laparoscopic technique does not impair oncological outcomes in patients undergoing resection for colon cancer. These results are similar to the findings of previous studies.[27-29]

The retrospective design of our study has inherent limitations. Some patients may have been missed due to coding

errors. In addition, the study utilized single-center data, which should be confirmed with multicentric prospective randomized controlled trials.

Conclusion

Laparoscopic and open right hemicolectomy surgery approaches had similar outcomes in terms of postoperative complications, mortality, and long-term oncological findings. The present study indicated that the laparoscopic approach did not offer significant advantages except for shorter hospital stays. On the contrary, the number of excised lymph nodes was lower. However, this did not affect long-term oncological outcomes. With increased laparoscopic experience and the routine practice of D3 dissection, the laparoscopic procedure can be performed safely with advantages such as smaller incisions, earlier recovery after surgery, shorter hospital stays, and faster return to normal life compared to open surgery.

Disclosures

Ethics Committee Approval: Ethics committee approval was not obtained for the retrospective study. However, the study was conducted in accordance with the principles of the Declaration of Helsinki.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.Y.; Design – M.Y, B.K.; Supervision – M.Y.,B.K.; Materials – .M.Y.; Data collection and/or processing – M.Y.; Analysis and/ or interpretation – M.Y.,B.K.; Literature search –M.Y.; Writing – M.Y.; Critical review – M.Y.,B.K.

References

1. Lu JY, Xu L, Xue HD, Zhou WX, Xu T, Qiu HZ, et al. The radical extent of lymphadenectomy - D2 dissection versus complete mesocolic excision of laparoscopic right colectomy for right-sided colon cancer (RELARC) trial: Study protocol for a randomized controlled trial. Trials 2016;17(1):582.
2. Levi F, Randimbison L, La Vecchia C. Trends in subsite distribution of colorectal cancers and polyps from the Vaud Cancer Registry. Cancer 1993;72:46–50.
3. Yamamoto S, Watanabe M, Hasegawa H, Kitajima M. Prospective evaluation of laparoscopic surgery for rectosigmoidal and rectal carcinoma. Dis Colon Rectum 2002;45:1648–54.
4. Veldkamp R, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, et al. Laparoscopic surgery versus open surgery for colon cancer: Short-term outcomes of a randomised trial. Lancet Oncol 2005;6(7):477–84.
5. Chaouch MA, Dougaz MW, Bouasker I, Jerraya H, Ghariani W, Khalfallah M, et al. Laparoscopic versus open complete mesocolon excision in right colon cancer: A systematic review and meta-analysis. World J Surg 2019;43(12):3179–90.
6. Barlehner E, Benhidjeb T, Ander S, Schicke B. Laparoscopic surgery for colon and rectal cancer. Surg Technol Int 2004;13:93–9.
7. Xiao Y, Qiu HZ, Wu B, Lin GL, Xiong GB, Niu BZ, et al. Outcome of laparoscopic radical right hemicolectomy with complete mesocolic resection and D3 lymphadenectomy. Zhonghua Wai Ke Za Zhi 2014;52(4):249–53.
8. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). Surg Laparosc Endosc 1991;1:144–50.
9. van der Pas MH, Haglind E, Cuesta MA, Fürst A, Lacy AM, Hop WC, et al; COlorectal cancer Laparoscopic or Open Resection II (COLOR II) Study Group. Laparoscopic versus open surgery for rectal cancer (COLOR II): Short-term outcomes of a randomised, phase 3 trial. Lancet Oncol 2013;14(3):210–8.
10. Bonjer HJ, Deijen CL, Abis GA, Cuesta MA, van der Pas MH, de Lange-de Klerk ES, et al; COLOR II Study Group. A randomized trial of laparoscopic versus open surgery for rectal cancer. N Engl J Med 2015;372(14):1324–32.
11. Matsuda T, Yamashita K, Hasegawa H, Utsumi M, Kakeji Y. Current status and trend of laparoscopic right hemicolectomy for colon cancer. Ann Gastroenterol Surg 2020;4(5):521–7.
12. Arezzo A, Passera R, Ferri V, Gonella F, Cirocchi R, Morino M. Laparoscopic right colectomy reduces short-term mortality and morbidity: Results of a systematic review and meta-analysis. Int J Colorectal Dis 2015;30(11):1457–72.
13. Zheng MH, Feng B, Lu AG, Li JW, Wang ML, Mao ZH, et al. Laparoscopic versus right hemicolectomy with curative intent for colon carcinoma. World J Gastroenterol 2005;11:323–6.
14. Tan WS, Chew MH, Ooi BS, Ng KH, Lim JF, Ho KS, et al. Laparoscopic versus open right hemicolectomy: A comparison of short-term outcomes. Int J Colorectal Dis 2009;24(11):1333–9.
15. Siani LM, Ferranti F, Marzano M, De Carlo A, Quintiliani A. Laparoscopic versus open right hemicolectomy: 5-year oncology results. Chir Ital [Article in Italian] 2009;61(5-6):573–7.
16. Jurowich C, Lichthardt S, Kastner C, Haubitz I, Prock A, Filser J, et al. Laparoscopic versus open right hemicolectomy in colon carcinoma: A propensity score analysis of the DGAV StuDoQ|ColonCancer registry. PLoS One 2019;14(6):e0218829.
17. Tong DK, Law WL. Laparoscopic versus open right hemicolectomy for carcinoma of the colon. JSLS 2007;11(1):76–80.
18. Zhao LY, Chi P, Ding WX, Huang SR, Zhang SF, Pan K, et al. Laparoscopic vs open extended right hemicolectomy for colon cancer. World J Gastroenterol 2014;20(24):7926–32.
19. Stergios K, Pergialiotis V, Frountzas M, Nalwaya P, Kontzoglou K, Mohapatra SD. Laparoscopic versus open colectomies: Enhanced surgical skills and rigorous patient selection may improve operative times without compromising outcomes. J Surg 2017;4(3):555–36.

20. Ng SS, Lee JF, Yiu RY, Li JC, Leung WW, Leung KL. Emergency laparoscopic-assisted versus open right hemicolectomy for obstructing right-sided colonic carcinoma: A comparative study of short-term clinical outcomes. World J Surg 2008;32:454–8.
21. Alkhamesi NA, Martin J, Schlachta CM. Cost-efficiency of laparoscopic versus open colon surgery in a tertiary care center. Surg Endosc 2011;25(11):3597–604.
22. Bae SU, Saklani AP, Lim DR, Kim DW, Hur H, Min BS, et al. Laparoscopic-assisted versus open complete mesocolic excision and central vascular ligation for right-sided colon cancer. Ann Surg Oncol 2014;21(7):2288–94.
23. Rausa E, Kelly ME, Asti E, Aiolfi A, Bonitta G, Bonavina L. Right hemicolectomy: A network meta-analysis comparing open, laparoscopic-assisted, total laparoscopic, and robotic approaches. Surg Endosc 2019;33(4):1020–32.
24. Li T, Meng XL, Chen W. Safety and short-term efficacy of a laparoscopic complete mesocolic excision for the surgical treatment of right hemicolon cancer. Clin Surg Res Commun 2018;2(2):29–33.
25. Bosker RJI, Van't Riet E, de Noo M, Vermaas M, Karsten TM, Pierie JP. Minimally invasive versus open approach for right-sided colectomy: A study in 12,006 patients from the Dutch Surgical Colorectal Audit. Dig Surg 2019;36(1):27–32.
26. Ding J, Liao GQ, Xia Y, Zhang ZM, Liu S, Yan ZS. Laparoscopic versus open right hemicolectomy for colon cancer: A meta-analysis. J Laparoendosc Adv Surg Tech A 2013;23(1):8–16.
27. Leung KL, Meng WC, Lee JF, Thung KH, Lai PB, Lau WY. Laparoscopic-assisted resection of right-sided colonic carcinoma: A case-control study. J Surg Oncol 1999;71:97–100.
28. Fujita J, Uyama I, Sugioka A, Komori Y, Matsui H, Hasumi A. Laparoscopic right hemicolectomy with radical lymph node dissection using the no-touch isolation technique for advanced colon cancer. Surg Today 2001;31:93–6.
29. Cirocchi R, Campanile FC, Di Saverio S, Popivanov G, Carlini L, Pironi D, et al. Laparoscopic versus open colectomy for obstructing right colon cancer: A systematic review and meta-analysis. J Visc Surg 2017;154(6):387–99.