Breast Cancer Research and Treatment (2020) 182:623–629
https://doi.org/10.1007/s10549-020-05721-3

CLINICAL TRIAL

The effect of 1-day multidisciplinary clinic on breast cancer treatment

Zohaib Akhtar[1] · Vered Stearns[2] · Paul Cartwright[3] · Amanda L. Blackford[4] · Vishnu Prasath[5] · Catherine Klein[5] · Danijela Jelovac[6] · Fariba Asrari[7] · Mehran Habibi[3]

Received: 17 December 2019 / Accepted: 2 June 2020 / Published online: 8 June 2020

Abstract

Purpose A delay in breast cancer treatment is associated with inferior survival outcomes; however, no clear guidelines exist defining the appropriate time frame from diagnosis to definitive treatment of breast cancer. A multidisciplinary approach for breast cancer treatment can minimize the time from diagnosis to first treatment. We hypothesized single-day multidisciplinary clinic (MDC) may accelerate the time to first treatment on complex breast cancer cases at our institution.

Methods We identified patients who were treated at Johns Hopkins for stage II or III breast cancer, who were at least 18 years of age, and were seen in a new single-day MDC with coordination between two or three specialties or by specialists from varying disciplines on different days (IDC). Patients who initiated treatment between May 2015 (initiation of MDC clinic) and December 2017 were included in our study.

Results A total of 296 patient records were reviewed independently. The mean (SD) patient age was 55 (13) years. The median time to first neoadjuvant chemotherapy (NACT) was significantly reduced for patients seen in the MDC (12.7 days), compared to those seen at the IDC (24.4 days, logrank $p < 0.001$). The median time to definitive surgery was similar between groups (31 and 32 days for the MDC and IDC cohorts, respectively).

Conclusions A single-day MDC visit is associated with a reduced time from diagnosis to NACT. Further studies are needed to determine if a shorter interval can improve the management and the outcome of complex breast cancer cases.

Keywords Multidisciplinary · Breast cancer · Neoadjuvant chemotherapy · Interdisciplinary · Oncology

Introduction

As the genetic and biologic characteristics of cancer subtypes become better understood, personalized treatment modalities are evolving at a rapid pace. Patients receiving combination therapies require a great deal of communication between medical specialists to properly combat multifaceted malignancies [1]. As a result, multidisciplinary clinics (MDCs) have emerged in recent decades to promote improved coordination between surgical oncologists, medical oncologists, radiation oncologists, and imaging [2]. The term multidisciplinary is often broadly used and inconsistently practiced yet the overall intent is universal in optimizing patient care through a team methodology [3].

The "conventional" multidisciplinary approach is often characterized by specialists from one or two disciplines seeing a patient when limited diagnostic information is available, which leads to inefficient use of resources and duplicate visits. Another multidisciplinary approach can be in the form of a "virtual MDC," which provides consultations

✉ Zohaib Akhtar
za@jhu.edu

1 School of Medicine, Johns Hopkins University, 4940 Eastern Ave, Room A-562, Baltimore, MD 21224, USA

2 Women's Malignancies Disease Group, Sidney Kimmel Comprehensive Cancer Center, Johns Hopkins University, Baltimore, MD, USA

3 Johns Hopkins Breast Center on the Johns Hopkins Bayview Campus, Baltimore, MD, USA

4 Division of Biostatistics, Department of Oncology, Johns Hopkins University, Baltimore, MD, USA

5 Department of Surgery, School of Medicine, Johns Hopkins University, Baltimore, MD, USA

6 Breast Cancer Program, Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, Baltimore, MD, USA

7 Johns Hopkins Breast Center – Green Spring Station, Johns Hopkins University, Baltimore, MD, USA

in close intervals from various medical experts who collectively stage and develop expert opinion at weekly tumor board meetings.

To further improve optimal multidisciplinary care, specialists have begun to implement single-day/single-site MDCs. The intent is not only to improve patient care and clinical outcomes, but also to enhance patient satisfaction by reducing stress and increasing convenience [4]. To further enhance this concept, we have developed a single-day/single-site MDC for patients with complex breast cancers as a pilot program at the Johns Hopkins Breast Center at Green Spring Station. Our goal was to provide a comprehensive assessment and review of each individual's needs during a 1-day visit with two to three specialists which include a needs assessment for additional imaging or genetic testing, a discussion of surgical and reconstructive options, and consideration of neoadjuvant chemotherapy (NACT) options. We hypothesized that single-day MDC may accelerate the time to receive treatment on complex breast cancer cases at our institution.

Multidisciplinary clinic model

To optimize patient care in breast cancer, a weekly breast cancer MDC was established at the Johns Hopkins at Green Spring Station in 2015. The location offered timely appointments with medical and radiation oncologists as well as breast surgeons for patients with newly diagnosed breast cancer. The center allowed physicians to work in close proximity and helped facilitate care in a more coordinated fashion. Unlike a standard visit at a breast cancer clinic, patient referrals are screened by the nurse navigator prior to visiting the MDC. A nurse navigator prepares a report including pertinent medical, pathology, and imaging reports to facilitate a streamlined initial encounter for all physicians involved.

On the day of visit, specifically selected patients are usually seen by a breast surgeon, a medical oncologist and a radiation oncologist, followed by an educational session by a nurse navigator. This is followed by a final meeting with all of the team members to review the plan of care, provide education, assess for barriers to treatment, and coordinate next steps. During the course of the day and at the completion of all appointments, the entire MDC breast cancer consortium engages in a comprehensive discussion to evaluate the stage and grade of breast disease and to develop a consensus recommendation. All the necessary labs, metastatic work up and scheduling for procedures such as a port insertion would be completed on the same day to streamline care and to minimize delays (Table 1). The 1-day MDC model required each patient be seen by at least two physicians within the same day along with the nurse navigator.

Patients and methods

Patients who were seen at two Johns Hopkins Maryland clinics, Johns Hopkins Hospital (JHH) and the Johns Hopkins Green Spring Clinic (GSS), were included. The JHH has an Interdisciplinary clinic (IDC) for breast cancer treatment, while the GSS has both the conventional IDC similar to JHH and a single-day MDC. The MDC was made available to all new patients meeting any of the following criterion: (1) triple-negative disease with tumor size greater than or equal to 2 cm; (2) Her2 receptor-positive disease with tumor size $\geq$ 2 cm; (3) metastatic disease to lymph nodes regardless of receptor status; (4) inflammatory breast cancer; and (5) pregnancy-related disease.

The patient data were collected retrospectively using the IRB-approved Research Database. Patients were included in this study if they were diagnosed with breast cancer stage II–III and initiated treatment between May 2015 and December 2017. They must also have had a known, recorded first visit date to the clinic at JHH or GSS, could not have been seeking solely a second opinion, could not have previously received neoadjuvant hormone therapy and were not

Table 1 Breast cancer single-day MDC mock schedule

MDC protocol plan	Average time
Prior to MDC visit	
Nurse navigator obtains pertinent medical information for initial encounter	15–20 min/patient
Clinic day	
Breast surgeon and nurse navigator meets with patient to explain preliminary findings and describe MDC patient goals. This is followed by physical exam and discussions of treatment options	1.5 h
Encounter with medical oncology to discuss treatment options, such as neoadjuvant therapy, its potential benefits, treatment schedule and side effects	45 min to 1 h
Encounter with radiation oncology to discuss radiation therapy. Side effects are also discussed at this time	45 min to 1 h
The Multidisciplinary team meets to discuss and review all previous reports. All treatment options are communicated and collectively recommended	1 h
Discussion details are relayed to patient. Nurse navigator ends clinic day with recap and additional information	30–40 min

continuing treatment at Johns Hopkins started at another facility.

Characteristics of patients are summarized overall and compared between those seen at an IDC versus MDC with Fisher's exact tests for categorical measures and Wilcoxon rank sum tests for continuous measures. Time to treatment was calculated as the date of the first visit to the first day of NACT or surgery, whichever came first. Median time to treatment was estimated for NACT and surgery separately using the Kaplan–Meier method and compared between patients seen at an IDC versus MDC with the logrank test. Cox proportional hazards models were used to estimate the hazard ratio for the difference in time to treatment between groups and adjusted for age, race (Caucasian vs. non-Caucasian), and stage of disease. Analyses were completed with R version 3.6.0 [5].

Results

A total of 296 patients with clinical stage II–III (245 and 51, respectively) who received treatment (NACT or surgery) at a Johns Hopkins institute were selected, with 220 (74%) patients seen at an IDC and 76 (26%) seen at the MDC. Patients at the IDC first met with a surgical oncologist followed by separate visits with medical and radiation oncologists.

Patients' characteristics are summarized in Table 2. The mean (SD) patient age was 55 (13) years. 153 (55.2%) patients were Caucasian, 84 (30.3%) Black, and the rest identified as another race or did not specify a race. Overall, 196 patients (66%) had surgery as first treatment and 101 (34%) received NACT as first treatment. Among patients seen at the IDC, 154 (71%) had surgery first and 61 (28.5%) received NACT. At the MDC, 43 patients (51.8%) had surgery as first treatment and 40 (48.2%) received NACT as first treatment. Characteristics of patients between those seen at the MDC versus an IDC were similar.

The time from first visit at the MDC to NACT was shorter (median 13 days) than for those seen at the IDC (22 days, hazard ratio (HR) 3.5, 95% confidence interval (CI) [1.8, 6.9], $p < 0.001$, Table 3). The median time from first visit to surgery was not significantly different between patients seen at the MDC (32 days) than for those seen at IDC (31 days, HR: 1.2, 95%CI [0.72, 2.0], $p = 0.47$ Table 3, Fig. 1).

Among patients see at an IDC, there was no difference in median time to NACT according to location (JHH: 23 days and GSS: 22 days, HR: 0.57, 95% CI [0.27, 1.2], $p = 0.15$). Median time to surgery was shorter at JHH (JHH: 30 days and GSS 34 days, HR: 1.7, 95% CI [1.1, 2.6], $p = 0.02$) (Table 3, Fig. 1).

Table 2 Characteristics of patients, overall and by whether they were seen at an IDC or MDC

	Entire cohort $N = 296$ (%)	IDC $N = 220$ (%)	MDC $N = 76$ (%)	p
Age—mean (SD)	55.28 (12.65)	55.08 (12.97)	55.72 (11.97)	0.719
Race—no. (%)				
Black	84 (30.2)	63 (30.6)	21 (29.6)	0.981
White	153 (55.2)	113 (54.9)	40 (56.3)	
Other	40 (14.4)	30 (14.6)	10 (14.1)	
Missing	19	14	5	
Hispanic—no. (%)	6/264 (2.3)	6/203 (3)	0/61 (0)	0.341
Facility—no. (%)				
JH Green Spring (GSS)	166 (56.1)	90 (40.9)	76 (100)	
JH Main Campus (JHH)	130 (43.9)	130 (59.1)	0 (0)	
Receptor status				
PR+ no. (%)	181/289 (62.6)	140/217 (64.5)	41/72 (56.9)	0.263
ER+ no. (%)	201/289 (69.6)	158/218 (72.5)	43/71 (60.6)	0.074
HER2+ no. (%)	65/279 (23.3)	51/210 (24.3)	14/69 (20.3)	0.623
AJCC stage				
II	246 (83.1)	187 (85)	59 (77.6)	0.156
III	50 (16.9)	33 (15)	17 (22.4)	
First treatment received—no. (%)				
Surgery	196 (66.2)	153 (69.5)	43 (56.6)	0.049
Neoadjuvant chemotherapy	100 (33.8)	67 (30.5)	33 (43.4)	

Table 3 Probability of treatment, surgery, or NACT by 14, 30, and 60 days from date of first visit are shown. The median time to treatment and hazard ratios [95% CI] for differences in time to treatment, surgery, or NACT between patients seen at an MDC or IDC facility, adjusting for age, race, and disease stage

	N	Median TTT	14 days	30 days	60 days	HR	95% CI	*p*
Entire cohort: any treatment	296	27 [23, 29]	24 [19, 28]	59 [53, 64]	95 [91, 97]			
IDC: any treatment	220	29 [25, 32]	20 [14, 25]	55 [48, 62]	93 [88, 95]	1.0	–	
MDC: any treatment	76	19.5 [15, 27]	36 [24, 45]	71 [59, 80]	100 [NA, NA]	1.6	(1.3, 2.2)	< 0.0001
First treatment: surgery								
IDC:	153	31 [28, 34]	16 [10, 22]	50 [41, 57]	91 [85, 94]	1.0	–	
MDC	43	32 [27, 36]	7 [0, 14]	49 [31, 62]	100 [NA, NA]	1.2	(0.72, 2.0)	0.47
First treatment: NACT								
IDC	67	22 [17, 29]	27 [15, 37]	69 [55, 78]	97 [88, 99]	1.0		
MDC	33	13 [12, 14]	73 [52, 84]	100 [NA, NA	100 [NA, NA]	3.5	(1.8, 6.9)	< 0.001

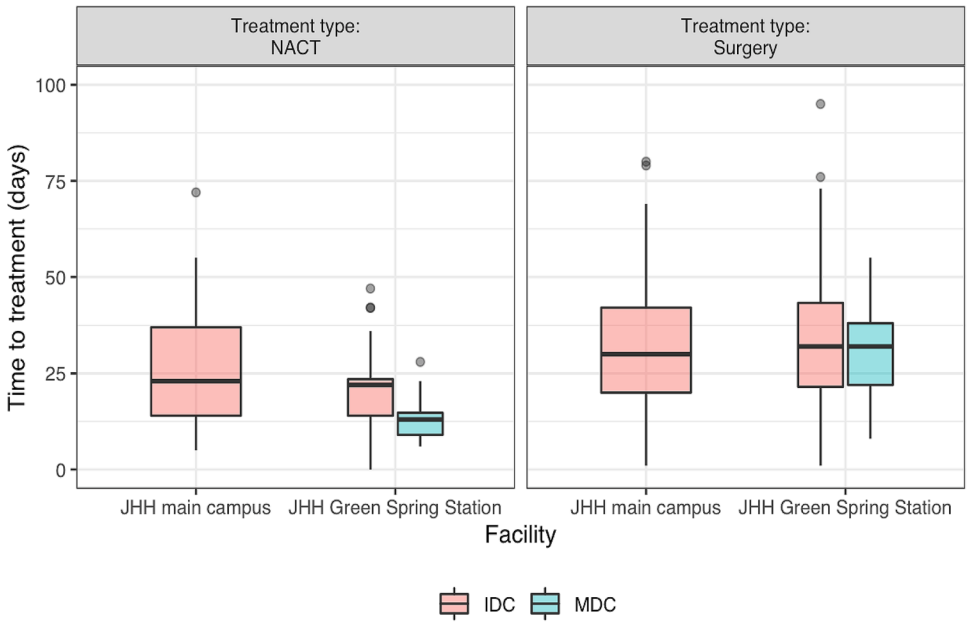

Fig. 1 IDC vs MDC, a boxplot of number of days from first visit to first treatment, in split by treatment type (NACT, surgery), facility (JHH main campus, JHH Green Spring Station), clinic approach (IDC, MDC).IDC: Inter-Disciplinary Clinic (N = 220)MDC: Multi-Disciplinary Clinic (N = 76) JHH: Johns Hopkins Hospital* no patients were censored and all received treatment

Discussion

We compared time to first treatment in patients with stage II and III breast cancer seen at a MDC practice or at a conventional clinic system at the same institute. We demonstrated that patients were able to initiate NACT more rapidly when they were seen at the single-day MDC compared to IDC in either two locations. We did not observe a difference in time to definitive surgery for patients who received this modality first.

Several studies have evaluated the time to treatment in breast cancer, and increasing delay has been found to have detrimental effects for surgery, chemotherapy, and radiotherapy [6]. The optimal timing for surgery or NACT for a patient with breast cancer is unknown. A delay in initiation for cancer treatment may decrease the benefit of cytotoxic systemic therapy [7]. Several groups have found that longer times to surgery and NACT can lead to measurable tumor growth and thus may have an adverse impact on outcomes [8–11]. Early diagnosis and treatment is considered a key factor in improving the outcomes in any cancer therapy with longer wait times influence clinical outcomes negatively, particularly mortality [12–15]. In regard to overall survival, the picture is more complex. A 2015 systemic review assessing breast cancers showed benefits for patients including earlier treatment, improved survival and improved quality of life [16]. In contrast, a recent study that examined the impact of timing of NACT initiation on long-term outcomes in breast cancer found no association between the survival outcomes and the delays in the diagnosis to treatment for NACT [17]. However,

another study found that time to treatment regardless of tumor subtype, has a measurable positive effect on overall survival [18]. Patient anxiety with increased wait times is another important consideration, and generally, shorter waiting times lead to greater patient satisfaction [19].

Single-day multidisciplinary cancer clinics remain difficult to institutionalize due to the paucity of literature demonstrating treatment benefits and the significant resource burdens implementation requires [1, 2]. The fact that a small set of patients must be seen by a coordinated group of physicians at a single-site over several hours remains the crux of much critique [1]. Despite these arguments, the multidisciplinary approach ensures high-quality diagnosis, evidence-based decision making, optimum treatment planning, and delivery of care. With a single-day approach, our study results show time to first treatment is significantly shortened for NACT in comparison to patients not seen in the single-day MDC for patients with stage II and III breast cancer. The reduction from a median of 22 to 13 days demonstrates a gross improvement in time to treatment NACT which may be beneficial in managing more complex breast cancer cases. Though there are no clear guidelines defining the most appropriate time period between diagnosis and definitive cancer treatments, recent literature supports a timely diagnostic workup is valued by patients and interval delays in cancer treatment decreases survival [20]. Moreover, a systematic review in breast and gynecological cancers reported 3–6 month delays in treatment are associated with lower overall survival [13, 21, 22]. In our study, we noted the probability of first treatment is lower in conventional system for NACT but the difference was not significant for surgery (Table 3, Fig. 2).

Dedicated single-day multidisciplinary centers for a variety of medical conditions have gradually emerged throughout the country. In the 1960s, two physicians at Stanford University created the first oncology MDC; nevertheless, many consider the pioneers in the approach to be breast centers as they have continued to establish favorable clinical outcomes since the 1980s [19, 23, 24]. A 1997 report by Gabel et al. noted 177 patients enrolled in a breast cancer MDC had increased patient satisfaction and decreased time between diagnosis and the initiation of treatment from 42.2 to 29.6 days [2]. Furthermore, Chang et al. and Newman et al. later described that breast MDCs led to changes in treatment recommendations among 43% and 45% of the cases examined, respectively [25, 26]. Currently, many MDCs offer same-day appointments by not only physicians but dieticians, nurse practitioners, psychologists, and physical therapists. Though many of these visits are crucial to developing treatment strategies, they can significantly decrease clinic efficiency as well as contribute to patient burnout. Patient feedback suggests toward the end of the visit around the third and fourth consultation, the sheer complexity and

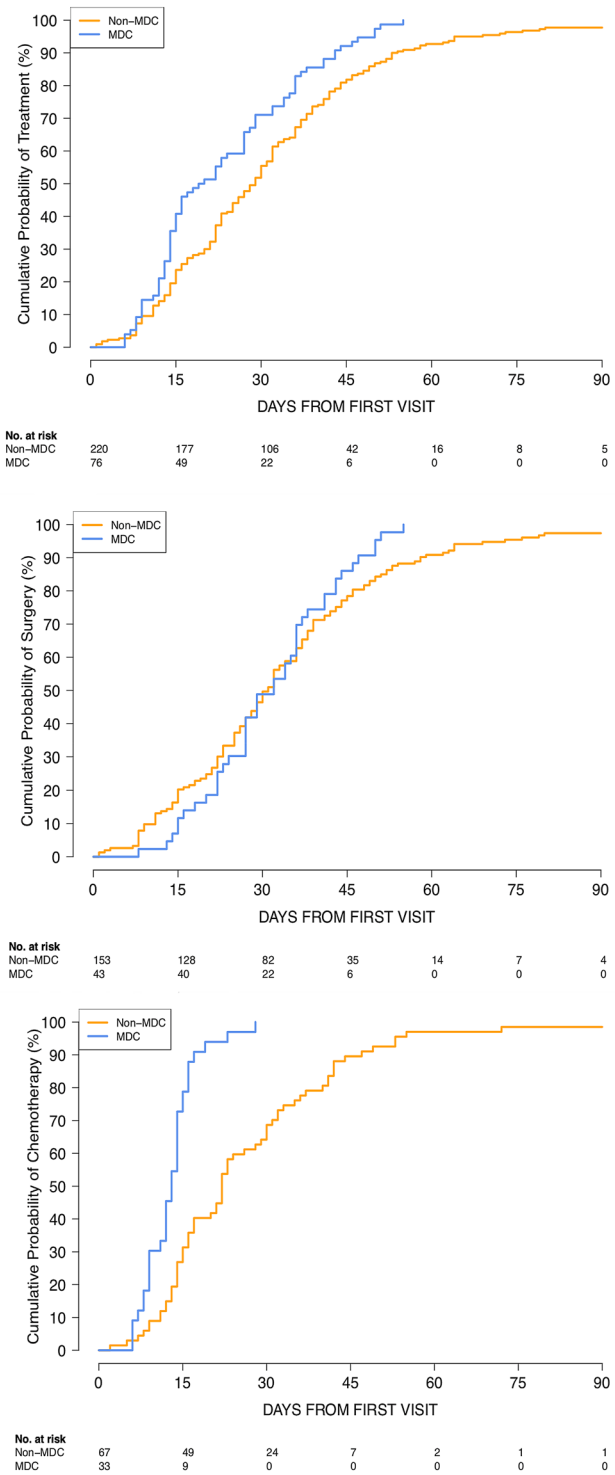

Fig. 2 Number at risk for the probability of time to first treatment over time from date of first visit between MDC and IDC

volume of information made it difficult to retain information. Consequently, the authors in this study opted for a more focused MDC approach that triaged patients based on the complexity of their disease and a potential need for

neoadjuvant therapy. Single-day patient appointments were limited in number and remained pertinent to surgical, radiation, and neoadjuvant therapies.

The quantitative reduction in time to first NACT as a function of the implementation of our breast MDC demonstrates the effectiveness of such a tool. The study shows targeted MDCs are capable of reducing time to treatment for the patient population for which they were designed. It was noted that the average time from diagnosis to first visit was reduced in the MDC for surgery and NACT. It is likely due to efficient communication between providers which enables them to implement steps necessary for NACT prior to eventual breast surgery. The MDC approach increases the chance individual patients are offered appropriate and prompt treatment for their condition, as management plans will be based on a broad range of expert knowledge, and all aspects influencing treatment options are considered.

The study had limitations including sample exclusions due to lack of information regarding treatment undertaken elsewhere and on patient satisfaction. The study was also retrospectively designed and lacked follow-up on patients continuing treatment at other institutes.

As we have recently opened new clinical spaces at Johns Hopkins, our results will be used to design specific MDC sessions aimed at specific breast cancer subgroups such as patients requiring reconstructive surgery or geriatric patients. These patients can be triaged to be more effectively treated. We will also investigate barriers and promote initiates that accelerate time to definitive surgery in our institution.

Author contributions Study concepts and design: VS, MH, ZA, DJ, FA. Data Analysis: MH, VS, AB, ZA. Statistical analyses: AB. Manuscript preparation: ZA. Manuscript editing: VS, MH, ZA, DJ, PC, VP, FA, AB. All authors read and approved the final manuscript.

Funding Supported in part by P30 CA06973 and an NCCN/Pfizer Award. Vered Stearns holds the Breast Cancer Research Chair in Oncology. The funding sources had no involvement in the study design; collection, analysis, and interpretation of data; writing of the report; or decision to submit the article for publication.

Compliance with ethical standards

Conflicts of interest None of the authors has a personal financial interest in this research. The authors declare that they have no conflicts of interest.

Ethical approval This study was approved by the university human research ethics committee and all procedures performed in studies involving human participants were in accordance with the ethical standards of the Johns Hopkins University Institutional Review Board (IRB) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was not required.

References

1. Pawlik TM et al (2008) Evaluating the impact of a single-day multidisciplinary clinic on the management of pancreatic cancer. Ann Surg Oncol 15:2081–2088
2. Gabel M, Hilton NE, Nathanson SD (1997) Multidisciplinary breast cancer clinics: do they work? Cancer 79:2380–2384
3. Saini KS et al (2012) Role of the multidisciplinary team in breast cancer management: results from a large international survey involving 39 countries. Ann Oncol 23:853–859
4. Zhang J et al (2013) Impact of a single-day multidisciplinary clinic on the management of patients with liver tumours. Curr Oncol 20:e123–e131
5. R Core Team (2019) R: a language and environment for statistical computing
6. Bleicher RJ (2018) Timing and delays in breast cancer evaluation and treatment. Ann Surg Oncol 25(10):2829–2838. https://doi.org/10.1245/s10434-018-6615-2
7. Gralow JR et al (2008) Preoperative therapy in invasive breast cancer: pathologic assessment and systemic therapy issues in operable disease. J Clin Oncol 26(5):814–819
8. Shannon C, Smith I (2003) Is there still a role for neoadjuvant therapy in breast cancer? Crit Rev Oncol Hematol 45(1):77–90
9. Walter P, Bernhard U, Menger M, Keller HE, Schorlemmer HU, Feifel G (1990) New immunosuppressive agents in experimental allogeneic heart transplantation. Transpl Proc 22(5):2324
10. Richards MA (2009) The size of the prize for earlier diagnosis of cancer in England. Br J Cancer 101(Suppl):S125–S129
11. Richard MA et al (1999) Melanoma and tumor thickness: challenges of early diagnosis. Arch Dermatol 135(3):269–274
12. Menczer J (2000) Diagnosis and treatment delay in gynecological malignancies. does it affect outcome? Int J Gynecol Cancer 10:89–94
13. Elit LM, O'Leary EM, Pond GR, Seow HY (2014) Impact of wait times on survival for women with uterine cancer. J Clin Oncol 32(1):27–33
14. Gobbi PG et al (2013) The prognostic role of time to diagnosis and presenting symptoms in patients with pancreatic cancer. Cancer Epidemiol 37(2):186–190
15. Pruitt SL, Harzke AJ, Davidson NO, Schootman M (2013) Do diagnostic and treatment delays for colorectal cancer increase risk of death? Cancer Causes Control 24(5):961–977
16. Neal RD et al (2015) Is increased time to diagnosis and treatment in symptomatic cancer associated with poorer outcomes? Systematic review. Br J Cancer 112:S92–S107
17. Livingston-Rosanoff D, Hanlon B, Marka N et al (2020) Time to initiation of neo-adjuvant chemotherapy for breast cancer treatment does not influence patient survival: a study of US breast cancer patients. Breast J 26(4):625–629. https://doi.org/10.1111/tbj.13625
18. Mateo AM, Mazor AM, Obeid E et al (2020) Time to surgery and the impact of delay in the non-Neoadjuvant setting on triple-negative breast cancers and other phenotypes. Ann Surg Oncol 27(5):1679–1692. https://doi.org/10.1245/s10434-019-08050-y
19. Saito AI, Suda M, Sasai K, Jagsi R (2016) Satisfaction of breast cancer patients regarding surgery and radiation therapy: a survey in Japan. Adv Radiat Oncol 1:216–221
20. Harness JK, Bartlett RH, Saran PA, Bord MA, Noble WC (1987) Developing a comprehensive breast center. Am Surg 53:419–423
21. Bleiche R et al (2016) Time to surgery and breast cancer survival in the United States. JAMA Oncol 2(3):330–339
22. Lee SH et al (2016) Tumor growth rate of invasive breast cancers during wait times for surgery assessed by ultrasonography. Medicine (Baltimore) 95(37):e4874

23. Friedman EL, Kruklitis RJ, Patson BJ, Sopka DM, Weiss MJ (2016) Effectiveness of a thoracic multidisciplinary clinic in the treatment of stage III non-small-cell lung cancer. J Multidiscip Healthc 9:267–274
24. Gupta T (2007) Multidisciplinary clinics in oncology: the hidden pitfalls. J Oncol Pract 3:72–73
25. Chang JH et al (2001) The impact of a multidisciplinary breast cancer center on recommendations for patient management: the University of Pennsylvania experience. Cancer 91(7):1231–1237
26. Newman EA et al (2006) Changes in surgical management resulting from case review at a breast cancer multldisciplinary tumor board. Cancer 107:2346–2351