Original Report

Impact of nurse navigation on timeliness of diagnostic medical services in patients with newly diagnosed lung cancer

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Background The Summa Cancer Institute in Akron, Ohio, sought to improve access to and the timeliness of lung cancer care by hiring an oncology-certified nurse navigator. The nurse navigator was charged with coordinating diagnostic procedures and specialty oncology consultations, and with facilitating a multidisciplinary thoracic oncology tumor board.
Objective To test the hypothesis that nurse navigation would improve the timeliness of and access to diagnostic medical services among men and women with newly diagnosed lung cancer.
Methods A conducted a retrospective review of 460 patients with lung cancer to evaluate access to care and the timeliness of the care received in the non-navigated and nurse-navigated cohorts.
Results During December 2009-September 2013, the time between the suspicion of cancer on chest X-ray to treatment was 64 days. During October 2013-March 2014, the nurse navigator helped reduce that timespan to 45 days ($P < .001$).
Limitations Long-term follow-up on clinical outcomes remains premature.
Conclusion This finding attests to the successful implementation of nurse navigation to improve access and timeliness of lung cancer care in a community oncology practice.

Timeliness of and access to diagnostic medical services has an impact on lung cancer care.[1-18] Up to 75% of American patients with lung cancer have advanced-stage or already metastasized disease at the time of diagnosis.[19] In the setting of advanced-stage lung cancer, clinical trials have demonstrated a compelling disease-free survival benefit when patients undergo radiation and platinum-based chemotherapy.[20-22] It remains unknown whether delays in diagnostic medical service marginalize the clinical benefit of radiation and platinum-based chemotherapy.

The diagnosis and staging of lung cancer relies on input from multiple medical and diagnostic service providers. The implementation of a coordinated roadmap for the selective involvement of provider services, especially across a community-based cancer center network, can be accelerated when it involves effective communication between community-based lung cancer care providers and oncologists.[3] For example, the diagnosis and staging of lung cancer may involve bronchoscopic or percutaneous image-driven biopsies, sampling of mediastinal lymph nodes, pulmonary evaluations including lung function tests, and risk assessments for surgery, chemotherapy administration, or radiation treatment. Ancillary medical imaging studies such as contrast-enhanced computed tomography (CT), whole-body bone scans, whole-body positron emission tomography-CT (PET-CT) scans, or magnetic resonance imaging (MRI) of the brain might be requested before specialty oncologist consultation. Factoring in patient travel and non-overlapping provider clinical schedules, delays in the diagnosis and staging of lung cancer may be substantial. These observations do not arise from a lack of standards or guidelines but rather from the practical logistics of community oncology practice. Moreover, issues such as patient insurance coverage, service reimbursement, institutional culture and oncology practice trends, and the experience of practicing oncologists add to the complexity of delivering oncology therapies in communities.

To overcome some of these barriers, cancer centers have begun to use specialized nurses to navigate patients through the initial process of cancer care. It has not been rigorously evaluated whether the sharing of information, expertise, and joint planning improves the timeliness of lung cancer care. In

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TABLE 1 Pretreatment patient and lung tumor characteristics

Characteristic	Cohort, no. of patients (%) Non-navigated (n = 363)	Cohort, no. of patients (%) Nurse-navigated (n = 97)	*P* value*
Mean age, y (range)	67 (32-97)	68 (41-90)	.51
Sex			.003
Male	177 (49)	64 (66)	
Female	186 (51)	33 (33)	
Race			.48
Caucasian	301 (83)	84 (87)	
Black	50 (14)	12 (12)	
Hispanic	8 (2)	0 (0)	
Other	4 (1)	1 (1)	
ECOG PS			.10
0 or 1	224 (62)	69 (71)	
2 or 3	139 (38)	28 (29)	
Tumor stage			< .001
IA/B	134 (37)	24 (25)	
IIA/B	54 (15)	6 (6)	
IIIA	84 (23)	24 (25)	
IIIB	43 (12)	11 (11)	
IV	48 (13)	32 (33)	
Median tumor size, cm (range)	3.2 (0.9-11.8)	3.3 (0.9-13.4)	0.87
Histology			0.96
Adenocarcinoma	220 (61)	56 (58)	
Squamous cell carcinoma	113 (31)	31 (32)	
Small-cell carcinoma	30 (8)	10 (10)	

ECOG PS, Eastern Cooperative Oncology Group Performance Status

*Continuous variable, Student *t*-test; Categorical variable, chi-square test

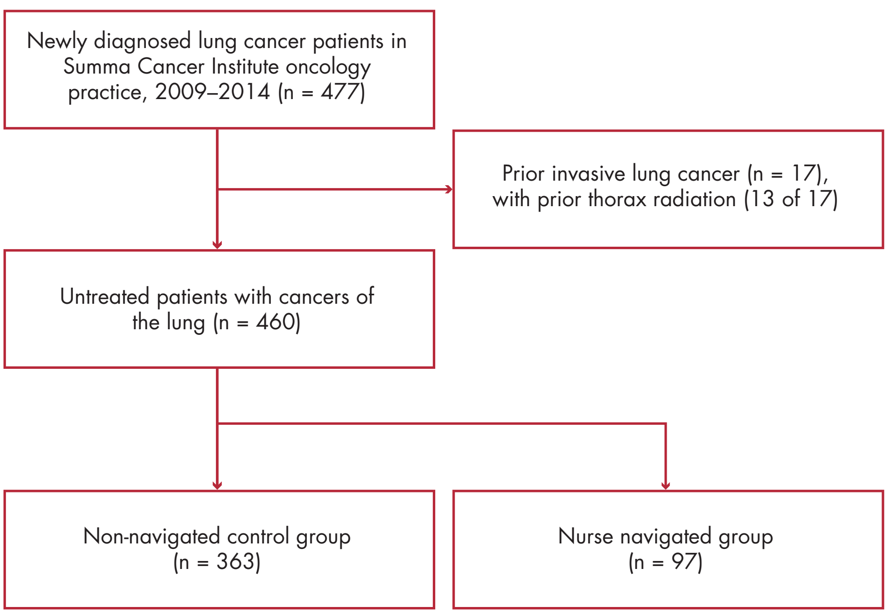

FIGURE STROBE diagram for progress through stages of analysis.

STROBE, Strengthening the Reporting of Observational Studies in Epidemiology

this study, we investigated whether nurse navigation would improve the timeliness of diagnostic medical services among men and women with newly diagnosed lung cancer in a community oncology practice.

Methods

Study population

Eligible patients had histologically proven stage I-IV adenocarcinoma, squamous cell, or small-cell lung cancer that had been diagnosed during December 2009-March 2014 (Table 1). Exclusion criteria included previous invasive cancer within 10 years of the lung cancer diagnosis, synchronous invasive cancers, or previous radiation to the thorax (Figure). Patients must have undergone a chest X-ray (or whole-lung chest CT scout film) within the Summa Cancer Institute (SCI) community oncology practice network to be included in this study. The SCI community oncology practice (Akron, Ohio) serves the clinical and cancer research needs of an urban manufacturing and rural agricultural region of nearly 1.1 million people in northeast Ohio. Institutional review board approval was obtained before the retrospective study was conducted.

Treatment

Surgical treatment involved an anatomic resection of the lung cancer tumor by pneumonectomy, lobectomy, or segmentectomy (wedge resection) as clinically determined by the thoracic oncology surgeon.

Chemotherapy treatment consisted of concurrent weekly paclitaxel at 50 mg/m^2 over 60 minutes followed by carboplatin at area under the serum concentration-time curve of 2 over 30 minutes on days 1, 8, 15, 22, 29, 36, and 43 of fractionated radiation therapy; or concurrent weekly cisplatin at 80 mg/m^2 over 60 minutes on Day 1, usually followed by etoposide at 100 mg/m^2 over 60 minutes on days 1-3 every 21 days; or other platinum-based regimens of various dose intensities and schedules. The number, dose intensities, and dose schedules of neoadjuvant or adjuvant chemotherapy cycles were nonuniform over the study period and were administered as clinically indicated.

Radiation therapy was delivered either by using three-dimensional conformal or intensity-modulated radiation therapy techniques to a cumulative dose ≥60 Gy; or using stereotactic radiosurgery techniques to 50 Gy in 5 fractions (n = 13), 50 Gy in 4 fractions (n = 1), or 60 Gy in 3 fractions (n = 1). Gross tumor volume was defined as the primary tumor and any lymph nodes exceeding 1 cm in greatest dimension. The gross tumor volume generally was expanded by 1-1.5 cm to achieve a planning tumor volume. Elective lymph node volumes were not included. No critical organ radiation planning guidelines were specified during the study period, but a normal lung volume receiving 20 Gy (V20) of ≤30% was met by most radiation therapy plans. Palliative radiation therapy dose and schedule administered to sites of metastatic lung cancer were also abstracted from the medical record.

Patient navigation

Patient navigation at the institute was conceived of from a desire to reduce communication barriers to timely, efficient, and high-quality lung cancer care. It was envisioned that an oncology-certified nurse navigator would streamline the diagnostic process, provide patient support and education, and coordinate specialty consultation in pulmonary medicine, surgical oncology, medical oncology, and radiation oncology. To qualify for the position, candidates had to have a nursing degree, current unrestricted license to practice nursing, and certification in oncology nursing. They were expected to have at least 3 years of practice experience in oncology nursing. The logistical support role of the nurse navigator included assisting in scheduling diagnostic imaging scans (eg, chest CT, whole body PET-CT, and brain MRI scans) and diagnostic procedures (eg, bronchoscopy and pulmonary function tests). A patient-centered care role involved patient needs assessments, patient education and psychosocial support, and assisting in care management through coordinated specialty oncology consultations with thoracic oncology surgeons, medical oncologists, and radiation oncologists recommended at a multidisciplinary thoracic specialty tumor board facilitated by the nurse navigator.

Statistical analysis

This retrospective study hypothesized that nurse navigation would improve the timeliness of diagnostic medical services among patients with newly diagnosed lung cancer. The role of the nurse navigator at our institute began October 1, 2013. This date split the institute's lung cancer care population into 2 cohorts – a historical control group that was tracked during December 2009-September 2013 (non-navigated cohort), and a nurse navigation group that was followed during October 2013-March 2014 (nurse-navigated cohort). Patient and tumor characteristics are shown in Table 1.

For this study, the referent diagnostic medical service was the date of the first abnormal chest X-ray (or CT scout film). Access to a diagnostic medical service was defined as the percentage of actual patients serviced to the total number of patients. Time to either chest CT or abdominopelvic CT scans, brain MRI scan, whole-body PET-CT, whole-body bone scan, bronchoscopy, or tissue diagnosis was calculated in days from the referent chest X-ray date to date of the diagnostic service. Time to first cancer treatment was determined in days from the referent chest X-ray date to the date of first surgical, chemotherapeutic, or radiotherapeutic intervention. Patients who entered palliative supportive care at diagnosis were excluded from the time to first cancer treatment analysis (n = 40).

Mean age, tumor size, and times to each diagnostic procedure were compared using Student *t* test. Patient sex, performance status, race, and lung cancer stage distributions were compared using the chi-square test. A *P* value $\alpha < .05$ (2-sided) was used to determine statistical significance using SPSS software version 18 (SPSS, Chicago, IL).

Results

Table 1 contains the pretreatment patient and tumor characteristics for the 363 non-navigated patients and 97 nurse-navigated patients. The median age was 67 years (range, 32-97). Most of the patients were male (52%), white non-Hispanic (84%), and had stage IIIA/B lung cancer (35%). During October 2013-March 2014, 32 of the 97 (33%) nurse-navigated, newly diagnosed lung cancer patients had metastases. Of those 32 patients, 10 (31%) had asymptomatic brain metastases identified by staging MRI scans. The median follow-up time for all patients was 10 months (range, 0-48). A total of 295 (64%) cancer relapses have occurred, with 187 (63%) happening in less than 6 months from initial lung cancer diagnosis. Lung cancer-related deaths have been recorded in 210 (46%) of the 460 patients, with 136 (65%) of the 210 deaths occurring in less than 12 months from initial lung cancer diagnosis. Insufficient follow-up in the nurse navigation cohort precludes comparative analysis of cancer relapse and cancer-related death patterns in the non-navigated and nurse-navigated patient cohorts.

Access to lung cancer care services

Nurse navigation increased the proportion of patients undergoing staging abdominopelvic CT scans (+7%), whole-body bone scans (+5%), and diagnostic bronchoscopy procedures (+5%; Table 2). The acquisition of a staging brain MRI significantly increased by 10% after nurse navigation was implemented. The proportion of patients undergoing staging PET-CT scans (-2%) remained similar between the control and nurse-navigated cohorts.

TABLE 2 Access to diagnostic medical service

Service	Cohort, no. of patients (%) Non-navigated (n = 363)	Nurse-navigated (n = 97)	*P* value
Chest CT scan	363 (100)	97 (100)	1.00
Abdominopelvic CT scan	86 (24)	30 (31)	0.14
Whole-body bone scan	64 (18)	22 (23)	0.26
MRI scan of brain	182 (50)	58 (60)	0.04
Whole-body PET-CT scan	249 (69)	65 (67)	0.76
Bronchoscopy	254 (70)	73 (75)	0.31

CT, computed tomography, MRI, magnetic resonance imaging, PET, positron emission tomography

*Categorical variable, chi-square test

TABLE 3 Days from abnormal chest X-ray to diagnostic medical service

Service	Cohort, mean no. of days (SD) Non-navigated (n = 363)	Nurse-navigated (n = 97)	*P* value
Chest CT scan	11 (28)	6 (10)	.003
Abdominopelvic CT scan	20 (38)	8 (15)	.022
Whole-body bone scan	29 (40)	12 (17)	.006
MRI scan of brain	30 (41)	24 (31)	.226
Whole-body PET-CT scan	34 (33)	24 (22)	.006
Bronchoscopy	45 (51)	25 (43)	.001
Tissue diagnosis	37 (45)	25 (25)	<.001

SD, standard deviation; CT, computed tomography; MRI, magnetic resonance imaging; PET; positron emission tomography

*Categorical variable, chi-square test

Timeliness of lung cancer care

Table 3 shows the days from first abnormal chest X-ray (or CT scout film) to diagnostic services and tissue diagnosis. Nurse navigation significantly reduced the time lag between the abnormal chest X-ray and most diagnostic medical services, with the single exception being staging brain MRI. Nurse navigation significantly improved time to tissue diagnosis by 12 days (Table 3, $P < .001$). Nurse navigation did not confer a trend toward earlier diagnosis of lung cancer, because newly diagnosed stage IV patients (n = 32) outnumbered stage IA/B patients (n = 24).

Among the 420 (91% of 460) patients who received definitive lung cancer treatment, surgery was performed in 187 (45%), chemotherapy alone in 69 (16%), radiation therapy alone in 54 (13%; stereotactic radiosurgery, 19 of 54 [35%]), and radiochemotherapy in 110 (26%). Palliative radiation therapy to sites of metastatic disease, as the first cancer treatment intervention, occurred in 19 (48%) of the remaining 40 patients. Nurse navigation significantly reduced the time to first cancer treatment by 19 days (nurse-navigated group: mean 45 days [standard deviation, 34]; control group: mean 64 days [standard deviation, 51]; $P < .001$). There was no impact of patient sex on the timeliness of lung cancer care ($P = .99$ control group; $P = .75$ nurse-navigated group).

Discussion

Lung cancer care involves a multidisciplinary team approach for timely and effective management of lung cancer.[1-3] In our community oncology practice, an oncology-certified nurse navigator was hired to streamline the lung cancer diagnostic process, provide patient support and education, and coordinate specialty consultation in pulmonary medicine, surgical oncology, medical oncology, and radiation oncology. This act provided a clear cohort-defining time point for measure of access to and timeliness of lung cancer care.

In the time period when our nurse navigator was actively guiding patient care, the access to diagnostic medical services such as staging abdominopelvic CT scans, whole-body bone scans, brain MRI, and diagnostic bronchoscopy improved (Table 2). Our finding of an increased number of diagnostic medical services suggests greater attention by our multidisciplinary thoracic oncology team to accurate patient lung cancer staging and then subsequent treatment assignment. In our community oncology practice, the referral patterns of diagnostic medical services have been well defined and consistent over the previous decade. Pulmonary medicine and oncology patient management have been relatively uniform over the same period. The key event and fundamental philosophical change for lung cancer care came with the hiring of our oncology-certified nurse navigator. Here, the role of the nurse navigator assumed 2 primary responsibilities – to expedite diagnostic procedures and specialty consultations, and to broker a weekly multidisciplinary thoracic oncology tumor board. Access to diagnostic medical service can be affected directly by face-to-face or telecommunication interaction of the nurse navigator and schedulers of medical services. Access might also be enhanced by increased service provider awareness, such as pulmonary medicine staff expanding bronchoscopy availability after discussion of new patient cases at a multidisciplinary thoracic oncology tumor board. In this study, the relative impact of nurse navigation compared with provider awareness cannot be distinguished because the nurse navigator roles of service expeditor and of tumor board facilitator activated simultaneously.

Timeliness of lung cancer care is often longer than recommended.[2] Mixed results have been observed regarding lung cancer care timeliness on survival: 3 studies have demonstrated worse survival,[4-6] 8 have shown no association,[7-14] and 4 have reported improved survival with delayed treatment.[15-18] Identifying an optimal time lag from first cancer suspicion to first cancer treatment has not been determined, but one health plan's goal is 31 days.[23] In our community oncology practice, the average time lag between the first abnormal chest X-ray (or CT scout film) to first cancer treatment was initially 64 days. But after hiring of the lung cancer nurse navigator, that lag narrowed to 45 days, a 19-day drop in time to first cancer treatment. For perspective, hiring an advanced practice nurse coordinator at the Connecticut Veterans Affairs Healthcare System, translated to an 81-day improvement to first cancer treatment.[1] In the present study, nurse navigation can be cited as a meaningful factor in the timeliness of lung cancer care. Again, it is difficult to isolate whether the service expeditor or the tumor board facilitator role was most critical to the significant reduction in time lag between first abnormal finding and first cancer treatment. Variables associated with less timely lung cancer care included being elderly (older than 70 years), being diagnosed in a teaching hospital, having the initial referral be to a nonpulmonary medicine physician, the number of diagnostic tests, the number of medical hospital services needed to achieve a diagnosis, and having greater than one medical comorbid health condition.[1-18]

Our retrospective study could be strengthened by longer follow-up in the nurse navigation group, because it is premature to evaluate the role of the nurse navigator on clinical outcomes. Our parent health system has begun a robust lung cancer screening program as suggested in a recent pulmonary medicine publication,[24] but it is not known whether lung cancer screening influences referral patterns for initial diagnostic medical services in our community oncology practice. In addition, it is not known whether our health system's primary care providers are fully aware of the lung cancer care nurse navigator's services, so the positive impact of the nurse navigator may be muted somewhat. Because of these particular factors, the impact of nurse navigation on the earlier diagnosis of lung cancer may be diminished.[1]

In conclusion, nurse navigation improved overall access and timeliness of lung cancer care in a community oncology practice serving an urban manufacturing and rural agricultural region of northeast Ohio.

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