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Retrospective Study

National Comprehensive Cancer Network guidelines compliance of a sarcoma service: A retrospective review

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Abstract**BACKGROUND**

Clinical workup and treatment guidelines have been published by the National Comprehensive Cancer Network (NCCN) to ensure patients are treated uniformly and appropriately. This study sought to retrospectively review patients with a new diagnosis of sarcoma who were treated in a National Cancer Institute (NCI) designated center and determine compliance rates with guidelines for sarcoma.

AIM

To evaluate our compliance of NCCN sarcoma guidelines at a major NCI designated center and to report instances of deviation that could be used for future studies to improve patient care.

METHODS

Data was collected retrospectively as an internal review and quality assessment of 35 newly diagnosed and treated patients. Demographic data were recorded and information concerning whether patients had appropriate imaging, biopsy and management. Variables of interest were expressed as raw numbers and percentages.

RESULTS

Primary site imaging was obtained in 100% of cases. Chest and full-body imaging were obtained in 97% and 100% of indicated cases, respectively. Tissue was obtained preoperatively in 97% of cases. Imaging was reviewed at multidisciplinary Treatment Planning Conference (TPC) in 97% of cases.

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Pathology was reviewed in 94% of cases in TPC. Both tumor, node, metastasis staging and plan of care were reviewed in 100% of cases in TPC. Treatment guidelines were followed in 94% of cases reviewed.

CONCLUSION

This study evaluated the workup and treatment provided by a single NCI designated sarcoma service to a series of patients with pathologies defined with the NCCN sarcoma treatment guidelines. Although adherence to NCCN was reported to be very high future prospective studies are required to investigate whether NCCN guidelines impact patient outcomes.

Key words: Soft tissue sarcoma; Bony sarcoma; Orthopedic; Oncology; Sarcoma guidelines; National Comprehensive Cancer Network

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Core tip: Clinical practice guidelines are necessary to ensure patients are treated equally and appropriately across all scenarios. This study is the first to investigate provider's compliance with the National Comprehensive Cancer Network (NCCN) guidelines on sarcoma. The findings from this study demonstrate that compliance with NCCN sarcoma guidelines is high within a single National Cancer Institute designated center. Although in other cancer diagnoses improved survival has been documented with compliance of NCCN guidelines it is currently unknown whether this observation applies to sarcoma. We feel this manuscript will encourage future research in the impact of NCCN guidelines on the outcomes of patients with sarcoma who are treated at both National Cancer Institute designated and non-designated centers.

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INTRODUCTION

Annually in the United States there are approximately 10000 new cases of soft tissue and bone sarcomas diagnosed and treated^[1]. Due to the relative infrequency of these malignancies, many providers are unfamiliar with the appropriate diagnostic and treatment courses required. Specialized centers are able to provide an experienced, multidisciplinary team, which is able to more appropriately treat these patients. The National Cancer Institute (NCI) has assigned various centers throughout the country as designated cancer institutes based on their volume and quality of care. These centers treat higher volumes of sarcoma patients and are proficient in all facets of sarcoma care. The National Comprehensive Cancer Network (NCCN) has also produced a series of evidence and consensus based guidelines for appropriate workup and treatment for many categories of malignancy including bone and soft tissue sarcoma (STS)^[2,3]. These guidelines are important to both higher and lower volume treatment centers in order to achieve uniformity and quality of care. A number of published series have examined compliance with NCCN guidelines^[4-10]. Several studies have found a positive association between compliance and clinical outcomes^[11-16]. Our study sought to determine if our high-volume sarcoma division followed the NCCN guidelines appropriately for bone and STS, and if not, where did the division deviate.

NCCN guidelines have been created in order to facilitate uniform, evidence-based workup and treatment for malignancies. Our group believes that because sarcoma is such a relatively infrequent malignant diagnosis encountered, that following the NCCN guidelines is crucial in order to optimize the patient workup and treatment. Our study sought to determine if our single NCI designated sarcoma division was compliant in following the established guidelines. If not, what errors occurred and how what improvements can be undertaken to the system in place.

MATERIALS AND METHODS

Data collection

This was a retrospective study that utilized data that was collected prospectively through routine care of patients. Data collected included the patient diagnosis, imaging obtained, procedures performed, adjuvant treatments received, and discussions from a weekly multidisciplinary care conference. After collection of the data we then reviewed each patient's workup and treatment course to determine if the appropriate imaging, procedures, adjuvant treatments, and discussion during multidisciplinary care conference were performed. Data were presented as total number and percent of total diagnoses, staging, treatment guideline protocols performed, and treatment recommendations. Data regarding compliance in each category as well as overall treatment guidelines compliance were presented as overall percentage.

Ethic statements

We performed an Institutional Review Board approved retrospective review of prospectively collected data from our orthopedic oncology outpatient clinic. Data were collected during a 6-mo period of time in 2016.

Patients selection

Patients were included in the series if they presented to our sarcoma clinic without a diagnosis yet of sarcoma and began their workup and treatment within our center. Inclusion diagnoses were bone and STS, giant cell tumors (GCTs) of bone, and desmoid tumors. These diagnoses were chosen as they all have guidelines within the published NCCN guidelines protocols. Patients were excluded from the study if they obtained significant workup or treatment by an outside provider prior to establishing themselves with our clinic. Patients were not included if they presented to the medical oncology clinic within our NCI center to begin workup. Finally, patients were excluded if they were lost to follow up or decided to have further care by another provider.

Statistical analysis

Descriptive and summary statistics were performed using STATA 16.0/IC software (StataCorp; College Station, TX, United States).

RESULTS

Thirty-five patients met inclusion criteria for the study from August of 2016 to February of 2017. The most common diagnoses were GCT of bone (7 cases, 20%), Undifferentiated pleomorphic sarcoma (4 cases, 11%), Liposarcoma (3 cases, 9%), synovial sarcoma (3 cases 9%), chondrosarcoma (3 cases, 9%) and desmoid tumor (3 cases, 9%) (Table 1). Other diagnoses included high- and low-grade STS, angiosarcoma, myxofibrosarcoma and epithelioid sarcoma. The most commonly used NCCN guidelines protocols included STS extremity guidelines (18 cases, 51%), GCT of bone guidelines (7 cases, 20%), STS-desmoid guidelines (3 cases, 9%), and Bone-chondrosarcoma guidelines (3 cases, 9%). Other guidelines used included STS-head guidelines and STS trunk guidelines. The most common staging at time of diagnosis was IV (5 cases, 14%), IIB (5 cases, 14%) and III (4 cases 11%). Ten cases of desmoids and GCT of bone required no formal malignancy staging. Surgery was recommended in 68%, radiation in 32%, and systemic therapy was recommended 29% of cases.

Primary site imaging was obtained in 100% of cases (Table 2). Chest imaging was obtained in 97% of cases. Full body imaging was obtained in 100% of indicated cases (5 cases). Tissue was obtained preoperatively in 97% of cases. Imaging was reviewed at multidisciplinary Treatment Planning Conference (TPC) in 97% of cases. Pathology was reviewed in 94% of cases in TPC. Tumor, node, metastasis staging was reviewed in 100% of cases in TPC. Plan of care was reviewed in 100% of cases at TPC. NCCN guidelines were followed appropriately in 94% of cases, the exceptions being a delay in obtaining chest imaging in one patient and not obtaining pre-resection tissue biopsy in a case of longstanding enchondroma, which developed into chondrosarcoma.

DISCUSSION

STS and bone sarcomas are relatively rare diagnoses in the United States, comprising

Table 1 Inclusion diagnoses

| Diagnosis | Total | Percent (%) |
|--------------------------------------|-------|-------------|
| Giant cell tumor of bone | 7 | 20 |
| Undifferentiated pleomorphic sarcoma | 4 | 11 |
| Soft tissue leiomyosarcoma | 3 | 9 |
| Liposarcoma | 3 | 9 |
| Extremity synovial sarcoma | 3 | 9 |
| Chondrosarcoma | 3 | 9 |
| Desmoid | 3 | 9 |
| High grade soft tissue sarcoma | 2 | 6 |
| Scalp soft tissue sarcoma | 2 | 6 |
| Low grade soft tissue sarcoma | 2 | 6 |
| Angiosarcoma | 1 | 3 |
| Myxofibrosarcoma | 1 | 3 |
| Epithelioid sarcoma | 1 | 3 |
| NCCN guidelines used | | |
| STS extremity guidelines | 18 | 51 |
| Bone: GCT of bone guidelines | 7 | 20 |
| Bone: Chondrosarcoma guidelines | 3 | 9 |
| STS head guidelines | 2 | 6 |
| STS desmoid | 3 | 9 |
| STS trunk guidelines | 2 | 6 |
| TNM staging | | |
| IA | 3 | 9 |
| IB | 4 | 11 |
| IIA | 3 | 9 |
| IIB | 5 | 14 |
| III | 4 | 11 |
| IV | 5 | 14 |
| IVA | 1 | 3 |
| No staging necessary | 10 | 29 |

NCCN: National Comprehensive Cancer Network; STS: Soft tissue sarcoma; TNM: Tumor, node, metastasis; GCT: Giant cell tumor.

approximately 10000 new cases annually^[1]. Because of the rarity of these pathologies, only specialized centers that treat high volumes of sarcoma have the experience and infrastructure available to appropriately manage these conditions. These centers are able to provide an experienced, multidisciplinary team, which is able to more appropriately treat these patients. These multidisciplinary care teams are the key to quality of care and have been analyzed extensively in the oncology literature^[17-23]. Although cancer centers around the world utilize multidisciplinary care teams, data supporting these teams is inconclusive. Obstacles in the way of this research include evolving treatment options over time, different definitions of what defines the team, and issues in creating a randomized trial^[24,25]. Regardless, multidisciplinary care has numerous theoretical advantages including involving specialists in each facet of care and having a forum for all providers to weigh in.

The NCI has assigned various centers throughout the country as designated cancer institutes based on their volume and quality of care. In order to better facilitate uniform care among diagnoses, the NCCN has published a series of evidence and consensus based guidelines for appropriate workup and treatment for many categories of malignancy including bone and STS^[2,3]. These guidelines are based on the available literature in each specialty as well as at times consensus expert opinion^[26]. These guidelines are universally accepted as the gold standard of care, and international agencies have used the NCCN guidelines as a framework for their own treatment algorithms^[27]. A number of other oncologic specialties have shown successful results in compliance with NCCN guidelines as well as improved outcomes when following the guidelines^[4,6-10,28,29]. Our group believes that because sarcoma is such a relatively infrequent malignant diagnosis encountered, that following the

Table 2 National Comprehensive Cancer Network guidelines compliance category

| NCCN guidelines compliance category | Percent compliance (%) |
|---|------------------------|
| Primary site imaging | 100 |
| Chest imaging | 97 |
| Full body imaging | 100 |
| Tissue obtained preoperatively | 97 |
| Imaging reviewed by multidisciplinary team | 97 |
| Pathology reviewed by multidisciplinary team | 94 |
| TNM stage reviewed by multidisciplinary team | 100 |
| Plan of care reviewed by multidisciplinary team | 100 |
| Treatment guidelines followed | 94 |

NCCN: National Comprehensive Cancer Network; TMN: Tumor, node, metastasis.

NCCN guidelines is crucial in order to optimize the patient workup and treatment. Our study sought to determine if our single NCI designated sarcoma division was compliant in following the established guidelines. If not, what errors occurred and what improvements can be undertaken to the system in place?

Limitations to this study include the relatively small sample size. Although our sarcoma division is a high-volume center, a large number of cases treated had already undergone significant workup or treatment by an outside provider before presenting to us. These patients were excluded from the study as their workup and treatment course is often more complex than patients who present to the division primarily. Another limitation includes the fact that some data is collected retrospectively although the majority is prospectively obtained as patients are seen in our office. During a retrospective review of one patient it was noted that chest imaging was not appropriately obtained and we were then able to order the test for the patient. This study in part provided a real-time quality assessment of our patient care.

In total we enrolled thirty-five patients, with the most common diagnoses including various forms of STS, followed by GCT of bone, followed by desmoid tumor, and chondrosarcoma. This does seem to be indicative of our adult orthopedic oncology practice overall. As the majority of cases were STS, we followed the STS extremity guidelines most often, followed by GCT of bone guidelines, followed by desmoid, and finally chondrosarcoma guidelines. The most common staging at time of diagnosis was IV (5 cases, 14%), IIB (5 cases, 14%) and III (4 cases 11%). Ten cases of desmoids and GCT of bone required no formal malignancy staging. Surgery was recommended in 68%, radiation in 32%, and systemic therapy was recommended 29% of cases. These findings were in line with the department's prior understanding of what common pathologies were treated on a regular basis. We believe that these ratios would be comparable to any adult orthopedic oncology practice at a NCCN treatment center.

Primary site imaging was obtained in 100% of cases. Chest imaging was obtained in 97% of cases. In fact, during retrospective data collection it was observed that one patient in the GCT guidelines protocol had not received appropriate chest imaging. This served as an alert to the team and we quickly ordered chest imaging on the patient. Because all data were collected either prospectively, or within a few days retrospectively, the study served as a quality assessment tool which in this case was able for the team to deliver care within the NCCN guidelines. Full body imaging was obtained in 100% of indicated cases (5 cases). Full body imaging was only required in a few select cases of angiosarcoma, epithelioid sarcoma, chondrosarcoma, and a tibial mixed mesenchymal sarcoma. Tissue was obtained preoperatively in 97% of cases. The single case without pre-resection tissue diagnosis was a case of an elderly patient with a longstanding history of a benign appearing cartilaginous lesion of his proximal humerus. This patient came to us with documented imaging dating back a number of years showing the lesion, however new imaging as well as a clinical exam was consistent with an aggressive chondrosarcoma with a pathologic fracture. As the diagnosis was quite clear, the multidisciplinary group came to the consensus that up-front surgery for wide resection and reconstruction was the appropriate choice. Imaging was reviewed at multidisciplinary TPC in 97% of cases. Pathology was reviewed in 94% of cases in TPC. Tumor, node, metastasis staging was reviewed in 100% of cases in TPC. Plan of care was reviewed in 100% of cases at TPC. Our multidisciplinary care conference prides itself in encouraging all members of the team to contribute to the conversation. We believe that this allows the conference to address each patient in a more complete manner. Treatment guidelines were followed in 94%

of all cases reviewed. The two cases of failed compliance include the lack of chest imaging in the GCT treatment guidelines and the lack of pre-resection tissue diagnosis for the chondrosarcoma of the proximal humerus. Overall, the clinic did show a very high rate of compliance and we do not believe that these two errors in any way effected the overall care of either patient involved.

This study is the first ever to investigate a NCI designated center's adherence to NCCN sarcoma treatment guidelines. Although previously reported studies have investigated the relationship of NCCN guideline adherence and patient outcomes in various other malignancies no one has evaluated sarcoma in this regard. It is necessary to shed light on adherence to NCCN sarcoma treatment guidelines as sarcoma is a rare entity that can be encountered in non-specialty settings and NCI designated centers. Furthermore, there are a wide variety of sarcoma subtypes with varying degrees of malignant potential that may alter providers adherence to NCCN guidelines. The heterogeneity seen by this sarcoma service was quite diverse, with GCT of bone and extremity STS being most common. It is clear that NCCN treatment guidelines can easily be adhered to regardless of histologic diagnosis and that all patients can possibly benefit. Overall rates of obtaining appropriate imaging and biopsy were very high (97%-100%), as was the rate of reviewing all pertinent information in a multidisciplinary TPC (94%-100%). NCCN guidelines were followed appropriately in 94% of cases, the exceptions being a delay in obtaining chest imaging in one patient and not obtaining pre-resection tissue biopsy in a case of longstanding enchondroma degenerated to chondrosarcoma.

This study documents very high compliance with NCCN guidelines across various diagnoses. It is unknown whether following these guidelines improve patient outcomes and survival. By following these NCCN guidelines we believe that patient care can be optimized and each case treated on an individually appropriate manner independent of specific tumor diagnosis. This study will promote future investigations into adherence with NCCN sarcoma treatment guidelines in both NCI and non-NCI designated centers. Future studies are also needed with larger patient enrollment and longer follow up to evaluate whether following these sarcoma guidelines diligently leads to improved care.

ARTICLE HIGHLIGHTS

Research background

National Comprehensive Cancer Network (NCCN) guidelines are imperative to ensure patients receive uniform and quality care. Reports have found a positive association between compliance of these guidelines and clinical outcomes in various malignancies. It is unknown whether large volume centers follow the NCCN guidelines when treating patients with sarcoma.

Research motivation

This study aims to investigate the compliance of a large National Cancer Institute (NCI) designated center with NCCN guidelines for the treatment of sarcoma. Deviation from these guidelines are important to acknowledge when attempting to improve patient outcomes.

Research objectives

The primary objective of this study was to identify the compliance rate of our center with NCCN sarcoma guidelines. If deviation from these guidelines were observed it was then necessary to identify factors associated with non-adherence to NCCN guidelines.

Research methods

This study was a retrospective review of prospectively collected data obtained through routine medical care at a single orthopedic oncology outpatient clinic.

Research results

Overall, NCCN guidelines on bone and soft tissue sarcoma were followed appropriately in 94% of cases reviewed. It was identified that there was a delay in obtaining staging chest imaging in one patient with giant cell tumor and lack of obtaining pre-resection tissue biopsy in a patient with chondrosarcoma.

Research conclusions

We are the first study to investigate compliance with NCCN sarcoma guidelines at a large NCI designated center. Although we report a high rate of overall compliance, we identified non-adherence with NCCN guidelines in 2 patients. Further research is required to determine if compliance with NCCN sarcoma guidelines is associated with improve patient outcomes.

Research perspectives

NCCN guidelines establish evidence and consensus based guidelines for the diagnostic evaluation and treatment of many different malignancies. There are several reports detailing rates of NCCN compliance and the improved patient outcomes with adherence to these

guidelines. Further research is needed to determine if other NCI designated and non-designated centers share our reported compliance with NCCN sarcoma guidelines and to what degree patient outcomes are affected when there is deviation from these guidelines.

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