Supportive care and osteopathic medicine in pediatric oncology: perspectives of current oncology clinicians, caregivers, and patients

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Abstract
Background and objective Many children receiving chemotherapy struggle with therapy-induced side effects. To date, there has been no literature investigating the needs, knowledge, or implementation of osteopathic manipulative treatments (OMT) as a supportive care option in pediatric oncology. We hypothesized that pediatric oncology clinicians, caregivers, and patients have (a) limited knowledge of OMT and (b) dissatisfaction with current supportive care options and (c) would be interested in having OMT available during chemotherapy, once educated.

Methods Participants included three cohorts: (1) children aged ≥9 years, diagnosed with cancer and actively receiving chemotherapy; (2) their caregivers; and (3) oncology clinicians at Nationwide Children’s Hospital. Participants completed 1:1 semi-structured interviews, which were audio-recorded, transcribed, and analyzed for thematic content regarding their perception of supportive care measures and views on OMT. Quantitative data was summarized descriptively.

Results A total of 60 participants completed the interview. Participants demonstrated limited awareness of osteopathic medicine; no participant had more than “some” knowledge of OMT. After education about OMT using a brief video, all clinicians, caregivers, and 95% of patients were receptive to OMT as a supportive care option. Major themes included the following: (a) patients have uncontrolled chemotherapy side effects, (b) improved supportive care options are desired, and (c) osteopathic medicine is a favorable supportive care adjunct.

Conclusions Pediatric oncology clinicians, caregivers, and patients reported a need for better management of chemotherapy-associated side effects and an interest in utilizing OMT. These findings support further investigation into the safety, feasibility, and efficacy of implementing OMT in the pediatric oncology clinical setting.

Keywords Pediatric · Oncology · Osteopathic · Integrative medicine

Introduction

Survival rates for childhood cancer continue to rise, yet the side effects and long-term sequelae of anticancer chemotherapy remain an area of concern for clinicians, caregivers, and patients. Chemotherapy is the primary treatment for many types of pediatric cancers, and advancements continue to be made in the discovery of novel, more targeted, chemotherapy agents. Common therapy side effects can include pain, nausea, fatigue, constipation, and psychosocial struggles [1, 2]. Additional medications to combat side effects, unfortunately, each have their own side effect profiles [3]. In conjunction with pharmacologic therapies, supportive care therapies including physical therapy, complementary and alternative medicine (CAM), and massage therapy are utilized by children with cancer having side effects, with varying levels...
of success [4–6]. Studies show a need for continued investigation of therapies to prevent such side effects, improve symptom control, and optimize overall quality of life in children with cancer [7].

Osteopathic medicine is a distinct form of medical practice, defined by the National Center for Complementary and Integrative Health (NCCIH) as a “mind and body” complementary method that offers the added benefit of a hands-on approach to diagnoses and treatment of many medical conditions [8]. Doctor of Osteopathic (DO) physician training is identical to Medical Doctor (MD) physician training with the exception of some additional specialized focused classes. Osteopathic physicians receive 200 additional hours of dedicated training in the musculoskeletal system, nervous system, muscles, and bones. These types of physicians focus on disease prevention and strive to use hands-on techniques to help alleviate pain, restore motion, and influence the body to help function more efficiently. In addition to chemotherapy and medications, DO physicians have some hands-on techniques that can complement pharmaceuticals and surgeries. Although osteopathic medicine has been practiced since 1892 and an increasing number of physicians are being trained annually [9], there remains a lack of knowledge regarding this therapy. A large, single institutional hospital study surveying 474 employees showed that, while physicians in the hospital had the highest awareness, only 53.7% of respondents overall had any knowledge of osteopathic medicine [10].

There is limited research regarding knowledge gaps regarding osteopathic medicine in the oncology community among physicians, physician assistants, and advanced nurse practitioners. In addition, there have been no studies investigating caregiver and patient awareness of osteopathic medicine.

Osteopathic manipulative treatment (OMT) is one of the specialized therapeutic modalities used by DO physicians and incorporates techniques such as gentle stretching and manipulation to target specific muscle and nerve groups [11]. Studies have suggested that OMT has the potential to reduce constipation and pain [12–15] and decrease length of hospitalizations [12]; however, scarce literature evaluating the use of osteopathic medicine in either the adult or pediatric oncology disciplines exists. There are few studies addressing the safety and feasibility of utilizing OMT in the adult and pediatric populations, however no dedicated safety and feasibility studies in the pediatric oncology population [16, 17]. Given the need for improved therapies to combat unwanted side effects, combined with the paucity of osteopathic research, this study investigated clinician, caregiver, and patient knowledge of osteopathic medicine in the pediatric oncology population and explored the perception of possible utilization and barriers to OMT.

Methods

Participants

Following institutional review board approval, we recruited eligible clinicians and families from December 2018 to February 2019 at Nationwide Children’s Hospital. Inclusion criteria included (1) patients currently receiving chemotherapy, ≥9 years of age; (2) caregivers of an oncology patient receiving chemotherapy, 0–21 years of age; and (3) allopathic or osteopathic physicians or advanced nurse practitioners in the Division of Oncology at Nationwide Children’s Hospital. We excluded respondents unable to comprehend written English and participants unable to complete the study due to medical or learning disabilities. Total participants approached included 24 oncology clinicians, 21 pediatric oncology patients, and 20 caregivers of pediatric oncology patients. Of those approached, 20 clinicians, 20 caregivers, and 20 patients (including 6 patient/caregiver dyads) completed a semi-structured, qualitative interview in clinic.

Procedures and measures

A single trained investigator (J.B.) provided participants a brief education on OMT which included a script detailing osteopathic medicine followed by a 1-min video demonstrating OMT on a child (Supplemental Material 1). Participants then completed 1:1 semi-structured qualitative interviews with open-ended questions and self-reported quantitative questions in REDCap. Participants were asked about the following: their experience with chemotherapy-induced side effects, how they have managed these side effects, how they felt OMT could potentially be utilized in the oncology setting, and any hesitancies about incorporating OMT into oncology care. Furthermore, clinicians and caregivers were asked how and when they felt OMT could be best introduced to their patient or child, respectively. Following the qualitative interview portion, participants were asked whether they would want to have OMT available as a supportive care option.

Data analysis

All quantitative responses were stored securely in a REDCap database. Interviews were audio-recorded and stored using an encrypted Apple iPad. All interviews were conducted by the same trained investigator (J.B.) to ensure consistency. Participants were compensated $10 for their time. Basic participant demographic information, such as age and gender, was collected and entered into a de-identified database.

Digital recordings were transcribed verbatim by an external service. Using an iterative process, two investigators on the research team (J.B., J.S.) independently analyzed and coded interview transcriptions using constant comparison method
Results

A total of 60 participants completed the interviews. Interviews lasted between 1.3 and 12.0 min (mean = 8.4 min). Twenty oncology clinicians participated (65% female), including 15 attending physicians and 5 nurse practitioners with a median of 7 years of clinical practice (SD = 6.8; range = 1–24). Twenty caregivers of pediatric oncology patients (65% female) with a median age of 40 years (range 27–71) and 20 pediatric oncology patients (30% female) with a median age of 17 years (range 10–28) completed the study. Leukemia (33%) and sarcoma (29%) were the most common cancer diagnoses, with a median of 15 years of age at diagnosis (range 9–21). Demographic characteristics are summarized in Table 1.

Quantitative knowledge of osteopathic medicine

Although 100% (n = 20) of clinicians had heard of osteopathic medicine, only 50% (n = 20) of caregivers and 0% (n = 20) of patients had heard of osteopathic medicine. Responses on their knowledge varied from 70% of clinicians knowing “some” to 30% knowing “very little” or “none at all.” In contrast, 85% of caregivers and 100% of patients knew “very little” or “none at all” about osteopathic medicine. Neither clinician, caregiver, nor patient knew “a lot.” On quantitative assessment, after receiving the video and script education, 100% of clinicians, 100% of caregivers, and 95% of patients responded “yes” when asked if they were interested in having osteopathic medicine available as an adjunct supportive care treatment option (Table 2).

Qualitative themes

Thematic content analyses of transcribed interviews resulted in identification of three major themes that were consistently observed across all three participant groups: (a) pediatric oncology patients have uncontrolled chemotherapy side effects, (b) desire for better supportive care options, and (c) osteopathic medicine is a favorable supportive care option (Table 3).

Theme 1: Patients have uncontrolled chemotherapy side effects

Participants were interviewed regarding their experiences with chemotherapy and disease side effects. All three groups reported specific instances where chemotherapy side effects were difficult to manage. Most commonly, participants experienced poor symptom management particularly for nausea, vomiting, constipation, neuropathy, and pain. Vincristine was a major identified source of uncontrolled side effects, including constipation and neuropathy. Some clinicians further expressed that vincristine side effects often lead to unwanted dose reductions. Clinicians, caregivers, and patients expressed frustration with currently available treatments including insufficiency of multiple pharmacologic interventions and a lack of alternative available options (Table 4). One clinician specializing in solid tumors reflected on his experiences with trial-and-error stating, “We tried different cocktails and try to get the best regimen for them. But it’s sometimes a guessing process to which ones are going to work the best and at times we fail initially.” In addition, clinicians reported that families felt frustrated and hopeless and were open to alternative therapy options to control side effects. One physician said, “Parents felt like medicines worked nominally but weren’t working enough, it was taking a long time, and generally they were very frustrated. They kind of knew these side effects were potentially out there but didn’t really sense or appreciate the gravity or the significance of them in terms of their impact.”

Theme 2: Desire for better supportive care options

All three cohorts expressed a need for better supportive care options to help control side effects. Participants expressed concern regarding a lack of available alternative supportive care therapies. Clinicians were often approached by patients and caregivers who specifically desired non-pharmacologic interventions to help with side effects and often felt clinician responses were inadequate. One clinician stated, “I’ve definitely had parents ask about more, or instead of medicine, is
there something else we can try. I haven’t been able to give them a great answer.” Patients viewed taking pills as a burden and expressed a desire for non-pharmacologic interventions, with multiple patients having similar views to a 12-year-old patient who stated “It’s just I wish I wasn’t on the pills. I wish there was a different way, because I hate taking pills.”

**Theme 3: OMT is a favorable supportive care option**

Following brief description and education about OMT, participants discussed various ways OMT may be utilized for chemotherapy side effects. Clinicians and caregivers expressed a desire to consider OMT when patients experience side effects that are not well-managed with pharmacologic-based therapies. They perceived OMT as an intervention that could potentially benefit nausea, vomiting, constipation, neuropathy, or pain. Clinicians, caregivers, and patients viewed OMT as an attractive therapy with the potential to be utilized at home and decrease as-needed medications. Some caregivers described the benefits of hands-on techniques, specifically the benefit of physical touch for healing.

While no major barriers were identified, participants elicited several smaller barriers before integrating OMT into their

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Table 1  Characteristics of participants

| Demographics | Providers | Patients | Caregiver |
|--------------|-----------|----------|-----------|
| Number of participants n | 20 | 20 | 20 |
| Male sex n (%) | 7 (35) | 12 (60) | 4 (20) |
| Race n (%) | White 17 (8-5) | White 18 (90) | White 19 (95) |
| Black 0 (0) | Black 2 (10) | Black 1 (5) |
| Other 3 (15) | Other 0 (0) | Other 0 (0) |
| Years of practice median (range) | Age (years) at diagnosis median (range) | Age (years) at survey median (range) |
| Oncology subspecialty n (%) | Type of cancer n (%) | Child’s cancer type n (%) |
| Leukemia 4 (20) | Leukemia 6 (30) | Leukemia 8 (40) |
| Lymphoma 2 (10) | Lymphoma 3 (15) | Lymphoma 2 (10) |
| Embryonal 4 (20) | Sarcoma 9 (45) | Sarcoma 8 (40) |
| Sarcoma 4 (20) | Central nervous system 2 (10) | Neuroblastoma 1 (5) |
| Neuro-oncology 4 (20) | Central nervous system 2 (10) | Neuroblastoma 1 (5) |
| General 2 (10) | Current on therapy n (%) | Relationship to patient n (%) |
| Medical doctorate 14 (7-0) | Age (years) at survey median (range) | Mother 14 (70) |
| Nurse practitioner 6 (30) | | Father 4 (20) |

Table 2  Knowledge and receptiveness to osteopathic medicine

| Question n (%) | Providers N = 20 | Caregivers N = 20 | Patients N = 20 |
|----------------|------------------|-------------------|----------------|
| 1. Have you heard of osteopathic medicine? | 20 (100) | 10 (50) | 0 (0) |
| Yes | | | |
| 2. How much do you feel you know about osteopathic medicine? | 0 (0) 14 | 0 (0) 3 | 0 (0) 0 |
| A lot | | | |
| Some | 70 (70) | 15 (15) | (0) |
| Very little | 5 (25) | 7 (35) | 0 (0) |
| None at all | 1 (5) | 10 (50) | 20 (100) |
| 3. Would you want osteopathic medicine available as a treatment option? | 20 (100) | 20 (100) | 19 (95) |
| Yes | | | |
current supportive care plans. After education about OMT, clinicians uniformly stated that they had minimal to no hesitation of recommending or referring their patients for OMT, yet they sought further education, as to when best to refer and how to introduce OMT to families. Similarly, caregivers also stated they would like printed or video educational materials describing OMT techniques. One clinician and one caregiver expressed concern about the availability of an osteopathic physician to perform treatments.

Participants were asked about their perceptions of the osteopathic techniques, specifically if they had any fears or hesitations. After watching the scripted video, caregivers and patients did not report any fears or hesitations. One patient stated, “Nothing scares me about OMT, I would love it.” Two patients expressed not wanting to be touched when they were ill, but one stated that if OMT were helpful, they would be willing to tolerate the physical touch. Other clinician’s comments centered on the need for additional research on osteopathic medicine in pediatric oncology patients to demonstrate efficacy and the feasibility of integration into clinic.

Clinicians and caregivers agreed that introduction to osteopathic medicine should occur early in the chemotherapy course. Several clinicians and caregivers stated that osteopathic medicine should be one of the first supportive care options discussed with families when chemotherapy side effects are explained during the initial consent process. Other clinicians and caregivers had some concerns about families being overwhelmed at the time of diagnosis and suggested opting for an introduction shortly after diagnosis. Regardless, most believed that having OMT available and offered within the first few weeks of therapy, before side effects arise, would be optimal. Many caregivers expressed at the end of interviews a desire to start OMT immediately, with one mother of a child with leukemia stating, “I’d try it right now if it were an option.”

Discussion

Using a mixed methods approach, we assessed current knowledge and perceptions of pediatric oncology clinicians, caregivers, and patients, regarding pediatric oncology supportive care and osteopathic medicine. In addition to confirming the universal desire for improvement in supportive care options, this study verified the relative lack of knowledge of OMT or its potential roles in supportive care. Most oncology clinicians had “some” to “very little” knowledge of osteopathic medicine, while caregivers had “very little” to “none at all,” and zero patients had knowledge of osteopathic medicine.

Current supportive care measures alone are frequently insufficient in treating pediatric chemotherapy side effects [20–22]. Participants acknowledged their most common uncontrolled symptoms including neuropathy, nausea, and constipation, which is congruent with previously reported findings regarding inadequately controlled side effects. Previous studies demonstrate increased compliance, adherence, and outcomes when chemotherapy side effects are controlled in children. Our findings strengthen the existing literature where patients, particularly those ≥ 9 years of age, do not like taking oral medications, leading to poor adherence to therapy [23]. Previous literature has demonstrated that approximately 50% of patients with chronic illness do not take oral medications as prescribed (i.e., the correct dose, time, day, and/or correct route) [24]. In conjunction with uncontrolled side effects, there are many non-pharmacologic, supportive care options that could potentially improve medication adherence [25, 26]; however, OMT has not yet been explored as a possible adjunctive therapeutic option. As our study participants shared frustration and dissatisfaction with available pharmacologic supportive care options, we recognize the use of CAM in pediatric patients continues to increase [27]. Although OMT is considered a “mind and body” practice by the NCCIH,

| Major themes and subthemes identified by participants | % Identified |
|-------------------------------------------------------|-------------|
| Common themes                                         | Providers N=20 | Caregivers N=20 | Patients N=20 |
| 1. Patients have uncontrolled chemotherapy side effects | 100%         | 100%          | 100%          |
| • Frustration                                         |             |               |               |
| • Dissatisfaction                                     |             |               |               |
| • Poor symptom management                            | 95%         | 95%          | 80%           |
| 2. Participants desire better supportive care options |             |               |               |
| • Lack of alternative therapies                       |             |               |               |
| • Non-pharmacologic interventions                     |             |               |               |
| 3. OMT is a favorable supportive care option           | 100%         | 100%          | 95%           |
| • Beneficial intervention                             |             |               |               |
| • Receptive                                           |             |               |               |

OMT osteopathic manipulative treatment
OMT is often included as a CAM modality in international studies, where patients have reported its use as an adjunct supportive care therapy. In a 2015 study from Switzerland, 53% of pediatric oncology patients utilized some form of CAM, with 13% of respondents utilizing osteopathic medicine [28]. As oncology caregivers and patients increasingly use non-traditional therapy options, clinicians must be knowledgeable on these interventions.

Familiarity with osteopathic medicine was low in all participants, indicating a significant knowledge gap. Our findings demonstrated that pediatric clinicians had less knowledge of osteopathic medicine compared to publications from adult-based literature, where most physicians felt “extremely knowledgeable.” This could be due to few osteopathic physicians at the institution practicing osteopathic medicine. Additionally, this discrepancy may be the result of a general lack of OMT practiced by osteopathic physicians at large pediatric institutions compared to rural adult hospitals [10].

Current literature does not include a role for OMT as a supportive care option, as it has not been studied in the childhood cancer population. Our study begins to address this gap by demonstrating minimal to no hesitation for OMT integration in all three participant groups. After education, participants were receptive to OMT, perceived it to be a low-risk,
Conclusions

This study investigates current knowledge and perspectives of pediatric oncology supportive care management and investigates the views of implementing OMT as an adjunctive treatment option. We identified a need from clinicians, patients, and their caregivers for better supportive care options and, after education, the desire to have osteopathic medicine available as an adjunct treatment. These findings support the need for future, scientifically rigorous clinical trials investigating the feasibility, safety, and efficacy of OMT as a non-pharmacologic adjunctive supportive care therapy option for childhood cancer patients.

Authors’ contributions Drs. Belsky and Rose conceptualized and designed the study, drafted the initial manuscript, and revised the manuscript. Mr. Stanek designed the data collection instruments, carried out statistical analyses, and reviewed and revised the manuscript. Drs. Gerhardt and Skeens conceptualized the study and reviewed and revised the manuscript.

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Data availability Not applicable.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Code availability Not applicable.

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