

SARCOMA TREATMENT AND FERTILITY OPTIONS

**YOUNG WOMEN WITH A DIAGNOSIS OF SARCOMA:
DECISIONS RELATED TO DISEASE TREATMENT AND
INFERTILITY OPTIONS**

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Abstract

Women suffering from sarcoma are often presented with the devastating news that they may experience infertility during or after chemotherapy and radiation treatment for the disease. Because of this, they must make the difficult decision to either go through with the treatments or explore options to preserve their fertility. Many of these women may be planning to have a family with biological children but undergoing chemotherapy and radiation treatment might make those plans impossible. This study examined therapeutic advances for preserving fertility in women while maintaining a therapeutic regimen for treatment of the disease. This research also examined the extent to which these patients have a full understanding of these treatments and if they are adequately informed of all of the available options from which to choose. This comprehensive review of the literature examined the psychological effects of potential infertility resulting from sarcoma treatment on women (18-44 years old) and their families. This study also explored the resources available to patients suffering from psychological effects of sarcoma treatment and infertility and the efficacy of these resources. The overall purpose of this study was to further examine the possible treatment options for these patients with an emphasis on the methods and resources to help them navigate this devastating diagnosis.

Key words: Sarcoma, Infertility, Fertility treatments, Psychological Effects, Women 18-44 years old.

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Introduction

Cancer affects about 1,735,350 million people each year and is the second most common cause of death in the United States. According to the American Cancer Society, “about 609,640 Americans are expected to die of cancer in 2018” (“Cancer Facts and Figures,” page 1). Sarcoma is one of the most aggressive types of cancer and affects bones and soft tissue like muscles, tendons, and fat. About 13,040 individuals are diagnosed with sarcoma each year and about 5,150 are expected to die from this form of cancer annually. Many advances have been achieved in the last few decades in the treatment of sarcoma, including chemotherapy, targeted therapy, surgery and radiation. Despite these advances, young men and women face profound side-effects from the various treatment modalities. However, this study focused on women of childbearing age. The overall purpose of this study was to examine further the possible treatment options for these patients with an emphasis on the methods and resources to help them navigate this devastating diagnosis.

Sub-objectives

1. What are the different types of sarcoma, their survival rates and pertinent treatment options?
2. What are the current treatment options for preserving fertility in female sarcoma patients?
3. What are the psychological effects of infertility on young female sarcoma patients?
4. What are the current options for the management of the psychological effects of potential infertility particularly depression and anxiety?

5. Discuss the complex decisions the young women patients, have to make regarding treatment for their cancer in light of possible infertility.

Methodology

The primary research method for this study was a systematic review of the literature regarding the available options for fertility preservation and management of the psychological effects related to potential infertility as a result of sarcoma treatment. The databases used for this research were CINAHL, Medline Plus, Medline, EBSCO, and Pub Med. About 15 peer reviewed research articles that contained full text of studies with populations of women within the age bracket of 19-44 were gathered and reviewed. The study compared the different sarcoma treatment and fertility preservation options and how they best applied to the young women based on age. The goal of the study was to provide data to the healthcare providers to facilitate discussions around disease treatment and fertility preservation.

Results

Sarcoma Types

According to the American Cancer Society, “about 609,640 Americans are expected to die of cancer in 2018” (“Cancer Facts and Figures,” 2018). Sarcoma is one of the most aggressive types of cancer and affects bones and soft tissue like muscles, tendons, and fat. About 13,040 individuals are diagnosed with sarcoma each year and about 5,150 are expected to die from this form of cancer annually. Soft tissue sarcomas

are a rare type of cancer that affect tissues that surround other body structures. They affect muscle, fat, tendons, nerves and lining of the joints. There are many different types of soft tissue sarcoma, including angiosarcoma, dermatofibrosarcoma, epithelioid sarcoma, gastrointestinal stromal tumor, kaposi's sarcoma, leiomyosarcoma, liposarcoma, malignant peripheral nerve sheath tumor, pleomorphic sarcoma, myxofibrosarcoma, rhabdomyosarcoma, solitary fibrous tumor, synovial sarcoma and undifferentiated pleomorphic sarcoma. These rare types of cancer are very difficult to diagnose because they rarely present symptoms and can easily be misdiagnosed, which makes treatment difficult since they are usually discovered later in the advanced stages. Treatment options for sarcoma are further complicated by the fact that current therapies can potentially cause infertility in young women.

In addition to soft tissue sarcomas, bone sarcomas like Ewing sarcoma and osteosarcoma affect both males and females and some common bone sarcomas are primarily diagnosed in children or adolescents. Joshua Lawrenz (2018) noted that, "On an annual basis, there are approximately 3,500 new patients diagnosed with primary bone sarcoma in the United States" (p.1). With the number of patients with sarcoma growing each year, there is the need for more research on treatment options.

Sarcoma Treatments and Survival Rates

There are several treatment options for sarcoma but they all vary patient to patient. The most common therapies include radiation, chemotherapies, immunotherapies, surgery, and psychological therapies to treat the patient holistically. Several studies were conducted to evaluate the effectiveness of these treatments. One of the most commonly prescribed and researched therapies is chemotherapy. Joshua

Lawrenz (2018) noted that, “While treatment almost always includes surgery, the addition of chemotherapy in the 1980s dramatically increased the survival. Similar to other cancer types, it is recommended that treatment be initiated as early in the disease course as possible to reduce the risk of metastatic spread or growth”. Lawrenz’s findings explain why chemotherapy is so commonly prescribed, based on its demonstrated efficacy in treating cancer.

In this study, Robert Benjamin (2017) described the history of therapy in patients with metastatic soft tissue sarcomas. This study included data obtained from randomized clinical trials and provided information about behaviors of different histological types of sarcoma, the importance of localized therapy for metastatic disease, and the critical role of combination chemotherapy in initial treatment to improve survival. Based on Benjamin’s histology-specific observations, patients with leiomyosarcoma had a longer time to next treatment and longer overall survival when compared to patients with other histologies. Benjamin explained that, “Unlike patients with leiomyosarcomas, patients with unclassified pleomorphic sarcomas (UPS) had a poor prognosis” (page. 2), which meant that they had the shortest time to next treatment and overall survival. Benjamin concluded, “new therapies aimed at this patient subset need development.” (p. 2). As Benjamin notes, different subsets of sarcomas respond differently to different treatments, suggesting a need to conduct further study aimed at matching specific treatments with each subset of sarcomas.

Benjamin (2017) also investigated the efficacy of combination chemotherapy. Under combination chemotherapy using doxorubicin and ifosfamide, Benjamin found improvement in survival rates with sarcoma patients. The author also emphasized that

combination chemotherapy was indicated for patients whose tumor shrinkage provided clinical benefits and warned of the risk for increased toxicity. With these findings, Benjamin concluded that, “it is time to stop recommending single-agent doxorubicin as initial therapy for any patient with metastatic soft tissue sarcoma who is fit enough to tolerate a combination, and direct future studies to improving the results.” (p.3).

Benjamin (2017) also suggested that patients who underwent localized therapy had better outcomes, including becoming disease free or having total control of the disease when compared to those who were treated systematically. The author noted that “localized strategies are particularly suited for patients with sarcomas because metastatic sites tend to be more limited than in other malignancies.” (p. 3). According to Benjamin, sarcomas may potentially respond well to localized therapy, as they tend to be smaller and easier to manage locally.

The article mentioned other treatment therapies like the use of pazopanib or trabectedin, gemcitabine-docetaxel combination which is said to be rare, but the author believes that it should be used in the treatment of leiomyosarcoma. Benjamin also highlighted the advantages of participating in clinical trials but noted that, “Only patients with good performance status and expected survival are eligible for trials, so they might be expected to do better.” (p. 3). Overall, Benjamin concluded that, “The power of a large database, expert pathology review, and expert management should be welcomed” (p.3) These are essential as they contain data and information that could help the patient decide on effective treatment plans.

In addition to chemotherapy, immunotherapy drugs have been prescribed to treat sarcomas. Hussein Tawbi (2017), conducted a study on the use of an immunotherapy

drug, pembrolizumab to treat both soft tissue sarcoma and bone sarcoma as an alternative to chemotherapy. He argued that “Patients with advanced sarcomas have a poor prognosis and few treatment options that improve overall survival. Chemotherapy and targeted therapies offer short-lived disease control.” (p.1493). Because chemotherapy was shown to be less effective in sarcoma patients, Tawbi studied “pembrolizumab, an anti-PD-1 antibody, for safety and activity in patients with advanced soft-tissue sarcoma or bone sarcoma.” This study used a two cohort, single arm, open label, phase two study and enrolled patients who were 18 years or older with soft tissue sarcoma, and patients with advanced bone sarcoma who were 12 years or older. All the patients had at least received two previous therapies. Of these patients, 86 received pembrolizumab and 80 were evaluated based on treatment response. Pembrolizumab was administered in 200 mg intravenously every 3 weeks and biopsies were obtained at baseline and during treatment. At a course of 19 months follow-up, the disease was assessed using CT scans or MRI. Even though the overall endpoint was not met, Tawbi noted that, “pembrolizumab showed encouraging activity in patients with undifferentiated pleomorphic sarcoma or dedifferentiated liposarcoma.” And that, “Enrollment to expanded cohorts of those subtypes is ongoing to confirm and characterize the activity of pembrolizumab.” (p.1493). Pembrolizumab is clinically still active and the studies are ongoing to investigate the effectiveness of the drug in treating sarcoma, but it shows promising signs as a treatment option.

There are several treatment options for sarcoma. Chemotherapy, radiation, and individual drugs have been shown to cause fertility issues in young women during or after the treatment for sarcoma and other cancers. These effects could be either

permanent or temporary. As health care professionals, doctors are expected to disclose all the possible side effects of all the drugs that will be used in the patient's course of treatment. This will increase patient's awareness of the consequences of treatment for better decision making. Therefore, it is essential for the patient, family member, health care proxy, or even friends to ask the necessary questions. Some of the questions that could be asked include:

- Could this treatment cause infertility or increase the risk of infertility?
- What other treatment options are available that could minimize the risk of infertility?
- Would you recommend that I speak to a fertility specialist before the start of my treatment?
- What other side effects should I expect during the course of the treatment?

Alessandra Longhi (2012) described how chemotherapy and radiation could have long and short-term effects on sarcoma patients. In this study, they evaluated the fertility status in males and females with osteosarcoma and Ewing sarcoma separately. Longhi evaluated 231 females with Osteosarcoma and 123 females with Ewing's sarcoma. The author determined that:

Of the 231 female patients with osteosarcoma who remained alive, 207 were evaluated for infertility; 53 were prepubertal and 154 postpubertal. In total, 115 postpubertal females (75%) experienced amenorrhea during chemotherapy. The median time to resumption of menstruation after chemotherapy was 4 months (range, 1-12 months). Only 6 of the females experienced permanent amenorrhea, and 4 of these were aged >35 years at the time of diagnosis. Those prepubertal

patients who had menarche after chemotherapy had no delay in puberty. In all, fertility was impaired in 6 of the 207 tested females (2.8%). (p. 5055).

Even though the number of patients with permanent amenorrhea was small, 6 patients were affected by the treatment and that cannot be overlooked. Longhi also determined that of the 123 female patients with Ewing sarcoma who remained alive, “25 had permanent amenorrhea—15 as a result of HDCT (high-dose chemotherapy) and 6 as a consequence of radiotherapy” (p. 5056). Given the small number of patients in this cohort study, more research may be needed to verify the results. However, the study does indicate how these treatments could affect fertility in young women. A total of 31 patients from both Osteosarcoma and Ewing sarcoma is a big number and should not be ignored.

The American Cancer Institute (2017) explained that:

Chemotherapy (especially alkylating agents) can affect the ovaries, causing them to stop releasing eggs and estrogen. This is called primary ovarian insufficiency (POI). Sometimes POI is temporary, and your menstrual periods and fertility return after treatment. Other times, damage to your ovaries is permanent and fertility doesn't return. You may have hot flashes, night sweats, irritability, vaginal dryness, and irregular or no menstrual periods. Chemotherapy can also lower the number of healthy eggs in the ovaries. Women who are closer to the age of natural menopause may have a greater risk of infertility. (“Female Fertility Issues,” para. 4).

This article also mentioned that radiotherapy that is directed to or near the abdomen, pelvis, or spine could affect the reproductive organs nearby. Radiation in the

brain could cause damage to the pituitary glands that signal the ovaries to produce the estrogen needed for ovulation. Surgeries carried out to treat cancer of the reproductive system could also damage nearby organs. Hormone therapy can disrupt the menstrual cycle, and immunotherapies could affect the immune system, both of which could affect fertility. Given the possibility of infertility in young female sarcoma patients, there are several treatment options available to preserve their fertility.

Treatment Options for Fertility Preservation

Several studies (Greve & Wielenga, 2013; Irtan & Orbach, 2013; Nalini, 2015; Sørensen & Greve, 2014; Vadaparampil, 2008) have demonstrated that fertility preservation is an option for female sarcoma patients and suggest different treatment modalities to improve the quality of and rates of survivorship. Some of the procedures mentioned in the studies include:

- Embryo cryopreservation
- Oocyte cryopreservation
- Ovarian Transposition
- Ovarian tissue cryopreservation (OCT)
- In vitro maturation (IVM)

Vadaparampil (2008) examined the level of awareness pediatric oncology nurses (PONs) have toward institutional guidelines for fertility preservation (FP) as well as the available options that vary by patient sex and cancer site. The author discussed cancers such as soft tissue sarcoma, Wilms tumors, Ewing sarcoma, osteosarcoma, non-Hodgkin's lymphoma, and their risk levels for infertility during or after treatment.

Vadapampil suggested that, “options for FP in females are less established than for males and also vary depending on the age of the patient,” noting options such as, “(1) shielding or removing ovaries from the field of radiation and (2) the removal of mature oocytes for in vitro fertilization and cryopreservation of the resulting embryos.” (p. 302).

Vadapampil (2008) believed that the knowledge nurses have about the resources and guidelines is a critical marker of institutional knowledge that is available to the patients and the effectiveness of their service delivery. As reported in this study, attendees of the 28th annual meeting of the Florida Association of Pediatric Tumor Programs (FAPTP) were invited to participate in a survey regarding the discussion of FP with pediatric oncology patients and their families. The majority of FAPTP attendees were PONs (>90%). From the results, a small portion of the respondents reported that their facilities had guidelines regarding which patient had to be offered sperm (12.3%) or ova cryopreservation (7.9%), and 37.2 % reported that their facilities offered counseling services for fertility issues. Most importantly, 75.4% indicated that there was a need for fertility guidelines and that fertility preservation for female patients was substantially lower than for male patients. Vadapampil concluded that:

Although FP options for males are more established than those available for females, it is notable that regardless of disease type, PONs reported consistently lower referrals for females. As options for females to become more established, it will be necessary to reexamine the offering of FP by disease types to ensure they are consistent with the risk profiles of the disease. (p.304).

Therefore, it is important that female patients understand their options for fertility treatment and more education should be provided on the status of their disease, risk factors, and the survival rates before they decide on the course of treatment.

Mahajan (2015) argued that “despite guidelines suggesting that discussion of fertility preservation should be done prior to starting cancer therapies, there is lack of implementation in that area.” (p.1). The author indicated that because there are many techniques for fertility preservation, some can be used either individually or together to maximize efficacy. The article mentioned the advantages and limitations of treatments such as Oocyte and embryo cryopreservation, noting that that “the need for fertility preservation has to be weighed against morbidity and mortality associated with cancer,” and that, “there is a need for multidisciplinary collaboration between oncologists and reproductive specialists to improve awareness and availability.” (p.1). Consequently, it is essential that service providers explain these procedures to patients in detail.

According to Nilani (2015), embryo cryopreservation requires the patient to go through IVF treatment. For a better success rate, the patient should be married or have a partner, and should be at least less than 35 years of age. This procedure is said to have good success rates depending on the number and quality of embryos. This procedure had a number of limitations that were required to be discussed with the ethical legal team, including the proper use of embryos in the event of patient death, and whether the partner or donor sperm is needed, which limits reproductive autonomy and may increase stress levels in the future for the patient. Also, this procedure cannot be performed in prepubertal patients.

Mature oocyte cryopreservation is another procedure where a woman who is unmarried or has no partner agrees to extract her eggs to be frozen and stored to preserve their reproductive potential in the future. According to Nilani (2015), “oocyte cryopreservation also requires the patient to go through ovarian stimulation and oocyte retrieval” (p.7). Nilani added that, “Data on pregnancy and live birth rates from oocyte cryopreservation in cancer patients are scarce, so success rates extrapolated from other populations such as young oocyte donors, have to be used for patient counseling.” (p.7). Even though the freezing or storing techniques have improved, chances of failure remain. But, when there are higher chances of failure with oocytes from cancer patients, the oocyte donors are usually available, a fact that should be brought up in counselling.

Ovarian tissue cryopreservation is a procedure where the ovarian cortical tissue or the outer layer of an ovary, that contains a large number of immature eggs, is extracted from the body and preserved for future use. According to Nilani (2015):

Ovarian tissue cryopreservation involves obtaining ovarian cortical tissue that is rich in primordial follicles, prior to ovarian failure by laparoscopy or laparotomy. Tissue is dissected into small fragments and cryopreserved by slow-cooling technique or vitrification. The tissue is transplanted after completion into the pelvis or outside the pelvis-abdominal wall, and forearm have been used.” In this case, there were more successful pregnancies with orthotopic transplantation and the author recommended that IVF treatments was necessary if Heterotopic transplantation was carried out. (p. 9).

Greve (2013) examined the risk of the presence of residual cancer cells in the ovarian cortex intended for transplantation. In this study, ovarian tissue stored for fertility

preservation from 16 surviving patients diagnosed with sarcoma (nine with Ewing sarcomas, four with osteosarcomas, two with synovial sarcomas, and one with chondrosarcoma) was evaluated for the presence of malignant cells by histology and by transplantation to immunodeficient mice for 20 weeks. A fraction of the tissue from patients with Ewing sarcoma was also evaluated for the presence of the molecular marker EWS-FLI1 by reverse transcription quantitative polymerase chain reaction (RT-qPCR). The transplant itself and selected murine organs were analyzed for the presence of malignant cells by histology. All of the mice were implanted with the human tissue for a 20-week transplantation period, but none of the mice developed any sign of cancer. In no instance were any cancer cells detected by histology or RT-qPCR. Greve (2013) concluded that:

Even though we have applied the best available methods and our results are encouraging for girls and women with sarcoma, the present results do not rule out potential contamination with malignant cells in the actual transplanted pieces as they are destroyed in the evaluation process. In the future it may become feasible to transplant isolated follicles or to mature oocytes in vitro in cases where safety is not completely clarified. This would eliminate the risk of transplanting malignant cells hidden in ovarian stromal tissue. Such methods have already produced live offspring in mice and mature oocyte in primates but are not available in humans despite intensive research. (p. 1937).

In other words, the procedure may seem safe in sarcoma surviving patients, but it would be safer if a sample of the ovarian tissue is evaluated for malignant cells before transplantation. In another study by Sabine Irtan (2013) Ovarian Transposition was

utilized as a way of preserving fertility in prepubescent and adolescent girls with cancer. It is a procedure where the ovaries are placed outside the irradiation field and then returned to their normal field after radiotherapy treatment. This field is determined by both the surgeon and the radiotherapist before the transposition. Irtan however noted that:

When a longer course of radiotherapy is needed (5–6 weeks), adhesions to the parietal peritoneum might prevent spontaneous return of the ovaries to the pelvis. Adnexal complications such as ovarian torsion and painful ovarian cysts have been reported in previous studies describing ovarian transposition techniques in adults, with some complication rates as high as 24%. Ovarian cysts after ovarian transposition have also been reported in children. (p. 605).

Therefore, patients and their parents or guardians must understand these possible side effects, as they might need to undergo other surgical procedures to resolve them before the procedures are carried out.

In vitro maturation (IVM) is another method for females to preserve their fertility. According to Mahajan (2015), it involves the aspiration of immature oocytes after minimal or no stimulation, followed by IVM and cryopreservation of mature oocyte embryos generated after fertilization. Mahajan stated that, “this technique has been performed experimentally and with good success in girls as young as 5 years... and data on efficacy and safety of IVM in cancer patients are not available.” (p. 8). In this case, extra precautions should be taken before and after this procedure. Other safer options should be explored by the patients because they might face even worse psychological effects if they don’t achieve their goals.

Psychological Effects on Young Sarcoma Patients

Given the burden of the diagnosis of cancer, possible infertility, and the potential failure in treatment for both the disease and the infertility, the patients and their loved ones may experience significant negative psychological effects. It is not easy for a young female cancer patient to live with the thought that her dream of one day giving birth and starting a family could be taken away. Therefore, they face major psychological effects which must to be addressed.

Croson & Keim-Malpass (2016) conducted a study to gain a unique perspective of young women with cancer between the ages 10-39 years, focusing on women who experienced challenges with fertility and parenting, through analysis of cancer blogs. The participants were 10 women aged 20-39 who maintained blogs about their experiences with cancer and infertility. Based on the findings, the participants' experiences aligned with Kubler Ross' (2016) stages of grief, including denial, anger, depression, and acceptance as an expression of grief. Croson & Keim-Malpas (2016) noted that denial manifested as "the desire to be selfless, which often accompanies mothers, does not suddenly shut off when they are diagnosed with cancer. They strive to keep moving forward for their families" (p.749). In other words, women will try and keep their normal routine such as cook meals for their families, pick up and drop off their children from school, go out with their friends, and work five days a week, while ignoring the current situation with their illness. They maintain a positive outlook in front of their children while confronting significant loss. Women tend to experience sadness thinking about potential significant loss including their lifestyles and dreams, which makes them strive to maintain their routines and keep up with their former lifestyles. Croson & Keim-

Malpas' viewpoint on anticipatory grief was that, "depression often arises in aspiring mothers in identity loss and the loss of the hope of the mother they thought they would be. The sadness is so poignant when these women, who had dreamed of motherhood, feel those dreams diminishing." (p.751). For example, one mother stated: "As thankful as I was to be in good health, and done with chemo, I am saddened by this loss, the loss of my fertility." (p. 751). Another woman described the moment when she realized that not only did she have cancer, but she was no longer able to have children: "I really hadn't given much thought to the fact that in the process of saving my life, I would become barren." (p.751). These kinds of emotions in young women can cause depression, from which they might not be able to recover, if the problem is not addressed. Therefore, it is essential that women should be provided with all options of fertility preservation.

Hershberger, Sipsma, Finnegan, & Hirshfeld-Cytron, (2016) describe the concerns for young women accepting or declining fertility preservation. These women often feel immense pressure to please their partners or family members. They also often feel substantial financial pressure from the cost of the preservation treatments. Hershberger reported that, "Participants who accepted fertility preservation and reported income less than \$30,000 per year described receiving financial support through their religious communities and neighborhood fundraisers. One participant who accepted fertility preservation indicated parental support as a co-reason: 'Mom and Dad have maxed out their plastic to help me to fulfill this dream.'" (p. 128). It is important to note that not all patients have access to the fundraising and family support. Consequently, the depression they experience, knowing that they would like to have the fertility preservation procedure but can't afford, weighs heavily on them. Patients in such

situations would benefit from the support and love from loved ones and their caretakers. All healthcare professionals should be able to provide the necessary referrals to help facilitate the needs of their patients, which includes counseling, community support groups, and any other information and resources.

Management of psychological effects of potential infertility

Management of psychological effects begins with the willingness of the patient to accept that there is a problem and then participate actively in the process, which is challenging for many patients. In most cases, patients are aware that they have a problem but often need assistance accepting and working through the necessary steps. This is a critical time for healthcare professionals, to provide all the necessary information to the patients to help them understand their condition and provide necessary referrals. Croson & Keim-Malpass (2016) noted that:

Acknowledging patients' grief processes allows nurses to provide social support—the information, advice, and aid provided to patients to reduce anxiety and distress. Social support can improve a patient's tolerance of stressful life events. In addition, researchers should expand on grief assessment tools to make them more applicable to this patient population and develop social support interventions. Young women tend to decline the need for support, while those in their social circles are looking for ways to support them. Nurses should encourage their patients to make a list of those who have offered to help them, and as specific needs arise, suggest that these women reach out to them. By pairing

needs with helpers, nurses can help patients maintain a sense of control over their situations. (p. 753).

As a result, nurses must be accessible to their patients and help guide them through this difficult time as well as work with their families and friends to provide social support, which can encourage the patients to discuss their grief.

In Wischmann's (2008) study on the usefulness of various methods of psychosocial support for infertility, several options were investigated, such as telephone counseling, booklets, educational films, using the internet for information, support groups, psychosocial counselling and psychotherapy from the participants. Wischmann (2008), found that:

Providing procedural information concerning the technical aspects of infertility investigation probably facilitates coping with infertility and with assisted reproductive techniques. This information can be given in the form of booklets or educational films. Using the Internet is a fast and easy way to obtain information on infertility and its treatment, but with the risk of getting wrong or misleading information. Telephone counseling can be helpful in providing specific information about the infertility workup, but it cannot replace face-to-face counseling on distressing psychosocial issues. Attendance at support groups can be recommended to strengthen coping abilities. Psychosocial counseling and psychotherapy are definitely effective in reducing negative affect, mostly within a short period of time (less than 10 sessions). Pregnancy rates are unlikely to be affected by psychosocial interventions. (p. 83).

Based on these results, face to face infertility counseling and support groups seem to be the most effective psychosocial interventions for infertility. Wischmann also stated that,

Infertility counseling should be available at all stages of medical therapy, and it should be free of charge for the persons attending it. Course content and goals of the infertility counseling should be made transparent. The efficacy of support groups has to be evaluated more systematically. Several methodological questions have to be solved yet, and the generalizability of these results is still restricted. (p. 88).

This infertility counseling presents an opportunity for healthcare professionals to provide the right referrals to the patients and encourage them to attend as well as emphasizing the importance of these therapies.

Even though SSRIs have been used in the treatment of anxiety and depression, the review of the literature on management of psychological effects in relation to infertility, revealed no studies describing the use of SSRIs in this population.

Another potential method for treating anxiety and depression is emotional disclosure. The study conducted by Panagopoulou, Montgomery, & Tarlatzis (2009) examined whether written emotional disclosure would reduce emotional distress and increase pregnancy rates in women undergoing in-vitro fertilization treatment. The authors found that:

The present study did not support the hypothesis that emotional disclosure reduces infertility-related or general psychological distress and improve pregnancy outcomes in women undergoing in-vitro fertilization treatment. One possible explanation for this finding concerns the timing of the intervention:

written emotional disclosure in anticipation of a stressful event might not be as effective as emotional disclosure employed after or during a stressful event. It is possible that while anticipating a stressful event, distraction-based strategies might be more effective than emotional-focusing ones. Several studies have shown the benefits of distraction while anticipating a stressful medical procedure. (p. 680).

In this study, the reader must keep in mind that women were not allowed to keep their dairies during the study, which could have influenced the results. Further research may be needed to determine the timing of the emotional disclosure.

In conclusion, these patients are confronted with many decisions to make regarding which treatments would be most effective for them. Based on the research provided, psychosocial support from healthcare professionals, family, partners/spouse, and friends has been shown to have the most significant impact on managing psychological effects in young women facing infertility while being treated for Sarcoma.

Decision-Making About Fertility

Given the frustration, pain, and stress experienced by young female cancer patients, they still have to make decisions as to how to proceed with their treatments for cancer, the potential fertility issues, and the psychological effects. This is a challenge that requires an entire web of support from both healthcare providers and loved ones in order to manage their disease effectively. Several studies have demonstrated many different ways to reach their decisions and given reasons why they came to those decisions (Hershberger, Sipsma, Finnegan, & Hirshfeld-Cytron, 2016; Gorman et al., 2014; Croson & Keim-Malpass 2016; Lawson et al., 2017).

In one study, Gorman et al., 2014 investigated decision-making around reproductive concerns among young female cancer survivors using the Reproductive Concerns After Cancer (RCAC) scale. The authors noted that:

Younger participants were more concerned about disclosing potential fertility problems with their (potential) partner but had similar scores across other subscales. Higher disclosure concerns could be explained by the fact that younger participants may be less likely to be in a committed relationship or to have already had a conversation with their partner. Those who had already had a child and those in a married or committed relationship were less concerned about disclosure, potentially because they and their partner already knew about their fertility status. (p. 224).

There was variability among participants based on their age, based on whether they had children or not, or based on their commitments in their different types of relationships. Therefore, the healthcare professionals must consider each woman's unique situation in providing psychosocial counseling and treatment options. In a qualitative study of young women diagnosed with cancer and eligible for fertility preservation, Hershberger, Sipsma, Finnegan, & Hirshfeld-Cytron (2016) investigated young women's reasons for accepting or declining fertility preservation after cancer diagnosis. The researchers found that:

The reasons why young women decided whether or not to undergo fertility preservation are captured within the original three dimensions (Cognitive Appraisals, Emotional Responses, Moral Judgments) and a new fourth dimension (Decision Partners) of the theoretical framework. Although all four dimensions

were important, many women delved deeply into their core values in the Emotional Responses dimension to determine whether the immediate emphasis of care should be placed on surviving cancer (declining) or securing options for future biological motherhood (accepting). (p. 130).

In this matter, the decisions often came down to whether or not women wanted to treat the cancer now or preserve the ability to have a child in the future. Lawson et al. (2017) investigated disparities in fertility preservation counseling (FPC) among women between the ages of 18-45 seeking cancer treatment. The study examined various demographic factors, including age, racial/ethnic background, marital status of the patient, insurance and financial status, and patient's diagnosis and it was noted that "The greatest predictor of who received FPC was the patient's cancer diagnosis" (pg. 888). The researchers concluded that, "although cancer diagnosis was the greatest predictor of FPC, disparities were evident in the counseling of female cancer patients for FP treatment. Equality in counseling female patients for FP treatment is imperative to reduce the risk of emotional harm and future infertility" (pg. 886). Although the focus of the study was on disparities in counselling services for fertility preservation, disparities in counselling specific for treatment decision making was also identified. Therefore, it is essential that patients receive all available information about the disease and treatment options, and support resources.

Discussion

This systematic review of the literature was conducted to examine the therapeutic advances for preserving fertility while maintaining a therapeutic regimen for treatment of the disease, as well as identifying and managing the psychological effects women might face. There were several treatment therapies for sarcoma, which vary from patient to patient. These include radiation, chemotherapies, immunotherapies, surgery, and psychological therapies to treat the patient holistically. Like other cancer types, it is recommended that treatment be initiated as early in the disease course as possible to reduce the risk of metastatic spread or growth. This study also found that it is important for the patient to ask their healthcare providers questions about their treatment options before they start treatment.

In Langhi (2012) and Tawbi (2017), there was a clear link between the treatment modalities and infertility. They describe how chemotherapy and radiation treatments could have long or short-term effects on sarcoma patients which included amenorrhea and infertility. Even though from their findings, the number of patients with amenorrhea looks small, these side effects cannot be overlooked. Research showed that fertility preservation for females is not as established as it is for males and shows consistently lower referrals for females. Vadaparampil (2008), Mahajan (2015), and Greve (2013) agree that there is a need for multidisciplinary collaboration between oncologists and reproductive specialists to improve awareness and availability of the different treatment options to the patients and their families. Compared to all the options reviewed, Oocyte cryopreservation has shown to have the highest success rates with fertility preservation in this literature review and is highly recommended.

Results from Wischmann (2008) revealed that face to face infertility counseling and support groups seem to be the most effective psychosocial interventions in infertility. Wischmann also urged that, “infertility counseling should be available at all stages of medical therapy, and it should be free of charge for the persons attending it.” (p. 88). It is vital that doctors and other healthcare professionals provide the necessary referrals to help facilitate the needs of their patients, such as counseling and community support groups, and to provide essential information regarding the patient’s treatment options.

Implications

As fertility preservation options for women become more established, it will be necessary to reexamine the available FP alternatives by disease types to ensure they are consistent with the risk profiles of the disease. It is important that female patients understand their options for fertility treatment. More patient education should be provided on the status of their disease, risk factors, and the survival rates before they decide on the course of treatment. The cost of cancer treatment and fertility preservation may be one of the greatest obstacles to receiving the treatments needed to improve the quality of healthcare for the young women diagnosed with sarcoma. Patients may need to explore different insurance options to determine the cost of the entire course of treatment and consider financial resources that they have available.

Limitations

While this review of the literature included some essential studies on the psychological effects of managing a cancer diagnosis while preserving fertility, there were few articles that focused on this important area of research. Access to more research in this area could increase for the findings of this review. The intention of this study was to focus specifically on sarcomas, but research focused specifically on sarcomas was also relatively scarce, so the search was expanded to include other forms of cancer. While the findings in these studies are likely still relevant, more research focused on sarcomas would have been preferable.

Conclusion

Women diagnosed with sarcoma are faced with not only the challenge of choosing treatment options, but also the challenge of preserving their fertility for the future. The studies reviewed indicate that healthcare professionals must not only provide options for disease treatment but also for fertility preservation. Doctors and other healthcare professionals should provide the necessary treatment options and referrals to help facilitate their patient's decision making around cancer treatment and fertility preservation. Healthcare professionals should provide individualized care that is reflective of each woman's unique situation. Each woman should be empowered to ask questions and to make decisions that are right for her and her family.

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