

A Cross Canada Survey of Sperm Banking Practices in Pediatric Oncology Centers

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Background. Childhood cancer survivors have identified fertility preservation as a major concern. Sperm banking is an established fertility preservation option in pubertal males. We sought to describe current practices in Canadian pediatric oncology programs, and to identify perceived barriers to sperm banking for male adolescents.

Procedure. A questionnaire was developed to (1) describe current sperm banking practices and facilities; (2) report on the utilization of sperm banking; and (3) identify barriers to sperm banking and possible solutions to improve current practices. A healthcare professional with an interest in fertility preservation within each institution was approached to participate in the study. **Results.** Fifteen of 16 institutions participated, 2 have fertility preservation teams. Only one has written guidelines or adolescent focused educational material. Over 2 years, 50/262 (19%) adolescents in 12 institutions successfully banked a specimen. In 11 of these, additional

information was available: of 85/172 (49%) adolescents offered the option to bank, 38/85 (45%) subsequently attempted. Reported barriers to sperm banking included the pressure to start therapy and restricted banking hours. Formal education of healthcare providers in fertility preservation practices, provision of financial support for families, and an adolescent focused approach were identified as important initiatives to improve sperm banking. **Conclusions.** There is a disparity in current sperm banking practices in Canada and at present, <25% of eligible male adolescents attempt to bank sperm. The development of a fertility preservation team, adolescent-specific guidelines, adolescent friendly sperm banking units, financial support, and improving knowledge translation among professionals and patients may improve the rates of banking. *Pediatr Blood Cancer.* 2010;55:1356–1361. © 2010 Wiley-Liss, Inc.

Key words: fertility preservation; oncology; pediatric

INTRODUCTION

Each year, over 1,200 Canadian children and adolescents (age 0–18 years) are diagnosed with a malignancy. With the use of current protocols, survival is a realistic outcome for more than 80% these children [1]. Thus, there has been increased focus on minimizing the late effects of cancer therapy in survivors. Many survivors of pediatric and adolescent cancers have identified future fertility as an outcome of major concern [2], and this has been echoed by the pediatric oncology community [3,4]. Chemotherapy, in particular the use of alkylating agents [5–7], and pelvic radiotherapy (at doses as low as 1–2 Gy) [8] can significantly reduce future reproductive potential, especially in males. Guidelines for the preservation of fertility in children with cancer have been published by the British Fertility Society [9], and the European Society of Human Reproduction and Embryology (ESHRE), has convened a task force to look at fertility preservation in severe diseases. Recently, the American Society of Clinical Oncology (ASCO) recommended that oncologists should address the possibility of infertility and fertility preservation with all patients treated during their reproductive years and that this should occur at the earliest possible opportunity [10].

Current preservation strategies fall into one of two categories: (1) aiming to preserve fertility by using minimally gonadotoxic protocols and (2) cryopreservation of sperm (in sexually mature males) with the restoration of fertility in later life using assisted fertility techniques such as intrauterine insemination or in vitro fertilization. There are no established methods for fertility preservation in pre-pubertal males and in female patients [11]. Despite cryopreservation of sperm representing an accepted option for fertility preservation in pubertal males [12,13], current sperm banking rates are low (<20%) [14]. Patient [3,15], physician [16–19], and system barriers [20] have all been identified as impeding the optimal delivery of sperm banking services.

Currently, the availability and provision of sperm banking programs in Canadian pediatric oncology centers are unknown. Therefore, this study aims to (1) describe the current practices and facilities for sperm banking in adolescents with cancer in Canadian

pediatric oncology centers; (2) to report on the utilization of sperm banking among male adolescent patients; and (3) to identify barriers to sperm banking identified by healthcare professionals and possible solutions to improve current practices.

METHODS

Approval for this study was obtained from the Research Ethics Board of the Hospital for Sick Children. A comprehensive review of the literature was conducted using OVID/Medline. Based on this review, a questionnaire (closed and open-ended questions) was designed to assess issues related to the optimal provision of sperm banking services at each institution. Factors assessed included institutional fertility preservation policies, procedures for facilitating sperm banking, sperm banking units, funding sources, and availability of adolescent focused information materials. Participants were asked to report perceived barriers to sperm banking in their institution and to suggest potential initiatives that may improve sperm banking rates. A medical professional with an interest in fertility preservation was identified and contacted to participate in this study at each of the 16 Canadian pediatric oncology institutions. Informants were provided the questionnaire in advance to allow them to prepare and gather any necessary data. A telephone survey was conducted where possible. If respondents were not available by phone, they were requested to respond in writing. Consent was implied by agreement to participate in the study and completion of the questionnaire. The survey was implemented as two-stage process. Barriers to sperm banking and potential initiatives to improve banking rates that were identified by respondents on the first survey were sum-

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TABLE I. Description of Participating Institutions and Their Fertility Preservation Resources

Institution number	New patients per year	Adolescent males per year	Fertility preservation policy		Preservation team	Educational sessions for staff
			Formal	Written		
1	60	5	Yes	No	No	No
2	130	15	Yes	No	No ^b	Yes
3	55	10	Yes	Yes	No ^b	No
4	65	7	No	No	No	No
5 ^a	20	4	No	No	No	No
6 ^a	55	10	Yes	No	No	No
7 ^a	80	10	No	No	No	No
8	75	12	Yes	No	No	Yes
9	40	5	No	No	No	No
10	400	45	No	No	No	No
11	65	15	Yes	No	No	No
12 ^a	120	40	No	No	No	No
13	20	4	No	No	Yes	No
14	25	5	No	No	Yes	No
15	20	4	Yes	No	No	No
Total	1,230	191	7/15	1/15	2/15	2/15

^aLocated within/adjoined to an adult oncology center, all other institutions are independent pediatric hospitals; ^bIn the process of developing a fertility preservation team.

marized. A follow-up survey was sent to the same respondents in which they were asked to rank the importance of each of these items to sperm banking at their institution on a 5-point Likert scale (1 strongly disagree and 5 strongly agree).

RESULTS

Responses were obtained from 15/16 (94%) institutions. Thirteen informants were interviewed by telephone and two responded by email. Fourteen informants were pediatric oncologists and one was a specialist nurse. Two (13%) institutions provide general educational sessions on fertility preservation to their staff, but none has specific training sessions on how to facilitate/arrange sperm banking in adolescents. Eleven (73%) of the institutions stated that they need to improve their approach to the provision of sperm banking.

The 15 participating institutions (Table I) treat 20–400 (median = 60) patients with a pediatric or adolescent malignancy annually. Of these, approximately 4–45 (median = 10) are male adolescents. Four (27%) institutions either have ($n = 2$) or are in the process of ($n = 2$) developing a dedicated “fertility preservation” team. Seven (47%) institutions have a “policy” that guides the provision of sperm banking, including which adolescents should be approached. However, the majority of these policies are limited to a verbal agreement among the medical staff; only one of the seven has a written policy document. Most institutions advocate that all male adolescents should be offered the option to bank regardless of diagnosis. However, in practice, the decision to offer an individual patient the option to bank sperm is at the discretion of the treating physician. A minimum age of 12 years and/or Tanner staging consistent with the onset of puberty was a uniform requirement for the discussion of sperm banking to occur. All 15 institutions uniformly felt that they should offer sperm banking to males with lymphoma, and those who will receive pelvic radiotherapy or a bone marrow transplant. For patients who receive an alkylating agent, such as cyclophosphamide or ifosfamide, 12 (80%) institutions would offer sperm banking regardless of dose, while 3 (20%) would offer bank-

ing based on the projected cumulative alkylating agent dose $\geq 4 \text{ g/m}^2$ of cyclophosphamide.

The approach to the initial discussion about fertility preservation and sperm banking is dependent on the individual providers' practice in seven (47%) institutions. Parents are uniformly approached without the adolescent present in two institutions (13%), and parents and adolescents are approached together in six (40%). No institution advocates for the adolescent to be approached first, separate from his parents. An educational pamphlet about the sperm banking process is available in nine (60%) institutions, but only one is specific to the adolescent age group; the remainder use generic adult-focused pamphlets. Consent is discussed and obtained by the sperm banking unit staff in all but two institutions, where the medical oncologist is responsible for this task. Only two (13%) of the banking units have adapted the consent form to be more adolescent appropriate with respect to language and content.

Of the 15 participating institutions, 12 (80%) provided details about sperm banking activities over the 2-year period preceding the survey. Approximately 262 male adolescent patients were treated during that time period, of whom only 50 (19%) successfully banked sperm. Eleven of the 12 institutions were able to provide additional details about the sperm banking process. Of approximately 172 male adolescents patients in these 11 institutions, almost half (85, 49%) were offered the option to bank. Of these 38/85 (45%) attempted to bank and 30/38 (79%) were able to produce a sample deemed adequate by the bank. Thus, 30/172 (17%) eligible patients successfully banked an adequate sperm sample.

All institutions are affiliated with at least one banking unit, of which only one unit has developed an adolescent-specific approach. Thirteen banking units (87%) are within the same city (median of 3 km away, range 1–250 km), including 3 units which are on-site. Adolescent patients in the other two institutions are required to travel to another city (150–250 km away) in order to bank. Referral to the unit is coordinated by the medical team alone or in conjunction with the family, except in one institution where referral is organized solely by the family. Twelve (80%) institutions reported that their

TABLE II. Costs Associated With Sperm Banking (Canadian Dollars)

Institution number	Initial visit	Annual storage	Estimated total cost ^a	Paid by family	Paid by hospital	Paid by charity
1	500	175	4,000	Partial	No	Partial
2	350	150	3,350	Partial	Partial	No
3	175	200	4,175	Partial	Partial	No
4	350	200	4,350	Yes	No	No
5	2,100	400	10,100	No	Yes	Yes
6	250	250	5,250	Yes	No	No
7	200	100	2,200	Yes	No	No
8	500	200	4,500	No	Yes	No
9	800	200	4,800	Yes	No	No
10	300	150	3,300	Yes	No	No
11	Unknown	200	4,000+	Yes	No	No
12	200	300	5,900	Yes	No	No
13	350	50	1,350	Yes	No	No
14	300	200	4,100	Yes	No	No
15	275	125	4,000	Yes	No	No
Mean	483	198	4,502			
Median	300	200	4,262			

^aBased on the adolescent banking a specimen at 14 years of age and storing the sample without use until 34 years old, as the average age of male at first marriage in Canada is 32 years old.

patients can expect to be seen within 1–2 days of referral; however, in two institutions, a delay of up to 7 days exists because of distance to the bank and blood work requirements. Fewer than half the institutions (40%) can facilitate evening or weekend banking if the need arises. Eleven of the 13 (85%) same city banking units will allow samples to be produced off-site if they can be brought for processing immediately. No pediatric oncology institution has an in-house room, which can be utilized for sample procurement for patients too unwell to go the sperm banking unit. Ten banking units are known to allow adolescents to use adult erotic material or to bring a partner when they come to bank.

The costs arising from the initial visit to provide a semen sample and the subsequent yearly storage vary among the different sperm banking units. In 10 (66%) institutions, the patient's families are responsible for covering these costs, but in 5 (33%) institutions partial or full funding is available from the institution or a local charity (Table II). In two of these five institutions, only the initial cost of banking is covered; in the remaining three, coverage for the annual banking fee is also provided. Only 7/15 (46%) of the institutions were aware of post-humous arrangements for stored sperm, which is for samples to be destroyed except where pre-designated for research purposes.

The means of the respondents' rankings on the follow-up survey of barriers to sperm banking and potential initiatives to improve banking rates are reported in Tables III and IV. The main reported barriers to the provision of sperm banking included the need to start therapy, restricted access to sperm banking units, and the lack of adolescent appropriate educational material. Respondents felt that the development of adolescent and parent focused educational material, provision of financial support, and formal training programs in fertility preservation to healthcare workers caring for the adolescents would be best initiatives to improve current sperm banking rates.

DISCUSSION

Future fertility is of significant concern to survivors of cancer during childhood or adolescence. Sperm banking provides a prac-

tical and non-invasive method of fertility preservation in pubescent males. Young adolescent males typically present with lymphomas and bone/soft tissue tumors and require treatment with protocols containing alkylating agents and/or radiation to the pelvic area. The proportion of male adolescents who could be at risk is unknown, but a prior study estimated that at least 50% of male adolescent patients presenting over a 1-year period would be at risk for infertility due to their cancer therapy [21]. There is general consensus that those who will receive gonadotoxic therapy, which potentially puts them at risk of future infertility impairment, should be offered the option to sperm banking. However, given the potential need for future high-dose therapy as a result of disease progression/relapse, there is an argument that even those deemed not to be at risk from first-line therapy should be encouraged to bank pre-therapy. Furthermore, a recent report highlights that chemotherapy exposure can result in a significant decrease in sperm DNA integrity [22], which may result in failure to conceive and an increased incidence of congenital abnormalities in progeny, though this has yet to borne out in the literature.

Beyond providing cancer survivors with the possibility of future fertility, banking of sperm has been shown to have a positive effect on the emotional battle against cancer [23]. The discussion and provision of fertility preservation to male adolescents with cancer raise many concerns and challenges for the physician, the patient, and the healthcare system within which this is being provided [24]. Less than 20% of eligible adolescent male patients in the institutions participating in this study successfully banked sperm, despite all institutions being affiliated with sperm banks, actively participating in the referral process, and offering educational pamphlets. This is consistent with a prior single institution Canadian study which demonstrated that only 18% (146/821) of males aged 14–30 years banked sperm [14].

There is a recognized variability in attitude, knowledge, and practice of sperm banking among oncologists, and a need for a uniform standard of practice with regard to who should be offered banking [16–18,24]. The decision to offer sperm banking is often based on age and signs of pubertal development. However, Tanner staging

TABLE III. Perceived Barriers to the Provision of Sperm Banking

Perceived barrier	Pooled rating ^a
Healthcare system	
The need to start cancer therapy without delay prevents many adolescents from banking	3.73
The sperm banking unit has restricted hours or is not accessible on weekends or evenings	3.53
No adolescent focused educational material in your pediatric center	3.47
No place in the pediatric center for sperm collection when an adolescent is too ill to go to the sperm banking unit	3.47
No adolescent focused guidelines in your sperm banking unit	3.07
No written sperm banking policy or guidelines in your pediatric center	2.87
A lack of co-ordination between your pediatric center and the sperm banking unit	2.40
The need to wait for screening blood work (i.e., viral studies) before adolescents can bank	2.33
No sperm banking unit in the your city	1.87
Healthcare worker	
Healthcare workers at my center lack specific education/training in discussing fertility preservation and sperm banking	3.07
Some healthcare workers at my center feel that adolescents are too young to discuss sperm banking with them	2.40
Some healthcare workers at my center are not aware that they should discuss sperm banking with adolescent patients	2.33
The religious/cultural beliefs of some healthcare workers at my center impedes their willingness to facilitate sperm banking	2.07
Healthcare workers at my center are too busy to have time to discuss sperm banking	1.87
Patient and family	
Adolescents are too ill at presentation to be able to bank sperm	3.13
Adolescents are not comfortable talking about sperm banking	2.87
Parents are not able to cover the cost of banking and/or storage	2.80
Adolescents are too stressed by their cancer diagnosis to bank sperm	2.53
Parents do not want sperm banking to be discussed with their child	2.20
Adolescents are not interested in discussing sperm banking	1.93

^aBased on scoring as per a Likert scale (1 strongly disagree, 5 strongly agree).

does not always correlate with spermarche, and males with low Tanner staging may have viable sperm [25–27]. Schrover et al. suggest that the option to bank sperm should be discussed with the adolescent alone and in the presence of their parents. Where there is a disagreement between adolescents and their parents, a health professional who has an expertise in oncology fertility issues should be available to mediate [3].

Prior studies have reported on the experiences of survivors in relation to the discussion of fertility preservation; some felt that banking was presented as a standard of care issue, whereas others felt that the healthcare provider appeared unsure or unconvincing [19]. Among adult oncologists, lack of knowledge about fertility preservation and resources or the referral process were identified

as physician barriers that impede the discussion of fertility preservation [20]. A recent study found that despite treating patients of childbearing age, less than half (241/516, 47%) of adult oncologists refer eligible patients to a reproductive endocrinologist [28]. Increasing awareness among pediatric healthcare professionals by providing educational supports and training sessions for all staff, but particularly those who will facilitate the sperm banking discussion and co-ordinate the process, may help to improve rates.

In Canadian pediatric oncology institutions, reported perceived barriers to fertility preservation include healthcare system, healthcare worker, and patient/family-related factors. Among the most significant impediments to sperm banking reported was the lack of an adolescent focused approach; specifically adolescent focused

TABLE IV. Potential Initiatives That Might Improve the Provision of Sperm Banking

Potential initiative	Pooled rating ^a
Healthcare system/worker	
Providing formal training programs in fertility preservation to healthcare workers caring for the adolescents in your center	4.33
Having a reference folder in your center with roadmaps or checklists	4.27
Developing a closer working relationship with the sperm banking unit	4.20
Increasing awareness among healthcare workers with reminders at staff meetings	4.07
Development of a formal fertility preservation policy in your center	4.00
Developing a local fertility preservation team in your center to discuss sperm banking and facilitate appointments in the sperm banking unit	3.73
Patient and family	
Providing adolescent focused educational material	4.67
Providing parent focused educational material	4.47
Providing families with financial assistance for the cost of the initial banking and subsequent storage	4.40
Providing alternative ways to collect samples for adolescents who wish to bank but cannot produce a sample, e.g., vibrostimulation, testicular biopsy	4.33

^aBased on scoring as per a Likert scale (1 strongly disagree, 5 strongly agree).

educational material. There is increasing awareness among health-care providers of the unique psychosocial disposition of adolescents. Adolescents have previously reported feeling uncomfortable talking to the treating physician or being rushed to make a decision [15]. Many sperm collection centers are not designed for the adolescent cancer patient and have been described in other studies as "soulless," "dank," and "miserable." For those who are unable to produce a sample due to their young age or sexual immaturity [3], an alternate means of sample acquisition including electro-ejaculation are useful, but no such technique is available in Canada at this time. For younger adolescents, the development of an adolescent-focused approach may be pivotal in engaging them in the process of sperm banking, particularly since a recent study suggested that the younger teens are less likely to bank [21]. Currently, only one Canadian institution has developed an age-appropriate educational pamphlet [29] and is affiliated with a sperm banking unit which has developed an adolescent-specific approach to care.

Other important reported barriers included pressure to start therapy and the restricted hours of access to sperm banking units. Units are typically within a short distance (<5 km) from the pediatric oncology institution, but less than half (40%) can facilitate banking in the evenings or on weekends, which necessitates a need to delay the start of therapy. Although in only 5/15 (33%) of institutions families could access partial of full funding, the majority (10/15) did not feel that it was a significant barrier to banking. However, over a projected storage period (till the patient is 34 years old which is a years after the average age of marriage in Canadian males) this amount is not an insignificant; particularly given that families of children with childhood cancer are known to incur a considerable economic burden during the cancer journey [30]. Up to 37% of families reported in one study that they needed to borrow money as a result of the financial demands of their child's illness [31]. More flexible sperm banking unit opening hours (evenings and weekends) and financial aid for families to cover the initial and storage costs may result in improved banking rates.

Healthcare workers continue to report that they lack specific education and training in how to discuss fertility preservation and sperm banking. It is concerning that despite the publication of ASCO guidelines advocating fertility preservation for all adolescent males, some physicians are unaware that they should discuss sperm banking and that for a small number, personal beliefs influence their decision to discuss sperm banking. The discussion around sperm banking is often difficult, as adolescents are often not comfortable talking about this topic, which may be related to the fact they are overwhelmed by their cancer diagnosis and/or fail to see what relevance this is to them at their stage in life. Respondents in our study identified the creation of formal training programs for healthcare professionals as the "healthcare worker" focused intervention most likely to improve banking rates. Schrover et al. are in the process of developing an interactive, multimedia educational DVD for oncologists and patients/families which may bridge this educational gap in the future [32].

At this time in Ontario, there is an initiative to develop an oncofertility© program for cancer patients; the optimal delivery of sperm banking services will be a key part of this process. Institutions should be encouraged to form a relationship with their affiliated sperm banking unit and to develop an "adolescent friendly" approach to the banking process with age-specific educational pamphlets, consent forms, and facilities. More flexible sperm banking unit opening hours (evenings and weekends) and financial aid for families to

cover the initial and storage costs may result in improved banking rates.

At this time there is no uniformity in the provision of sperm banking between Canadian institutions. Reports from the US, UK, and Australia/New Zealand have also demonstrated a lack of consistency and co-ordination of service provision, and there is in particular heterogeneity in the indications for banking at different institutions [33,34]. Recognizing these barriers, some pediatric institutions have developed specific sperm banking programs in order to facilitate sperm cryopreservation in adolescent males [35]. There are no Canadian guidelines pertaining to the provision of sperm banking to pediatric oncology patients to support institutions in the development of an optimal sperm banking service. Cognizant of this deficit, the Pediatric Oncology Group of Ontario (POGO) is currently working to develop fertility preservation guidelines and educational pamphlets for male adolescent oncology patients in Ontario.

This study is the first report of sperm banking practices across Canadian pediatric oncology institutions. The strengths of this study are that it includes almost all of the pediatric oncology centers in Canada. Although informants were selected based on their interest in fertility preservation and are all involved in the co-ordination of sperm banking in their institution, we cannot verify the objectivity or accuracy of each response. We were not able to obtain the opinions of adolescents treated in these institutions. As the key stakeholders, it is critical that the development of an optimal program be based on their opinions and suggestions.

In conclusion, this study highlights the disparity of sperm banking practices in 15 Canadian pediatric oncology centers and emphasizes that at present <20% of male adolescents' bank successfully. Promotion of awareness and education of healthcare providers, adoption of an adolescent-specific approach, and the development of guidelines may lead to a more uniform approach to fertility preservation with improved sperm banking rates and will be the focus of future research.

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