Case Presentation: Sperm Banking in Patient Diagnosed with Acute Myeloid Leukemia

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Case Presentation

A 23-year-old man presented to a referring hospital emergency room with gradually worsening throat pain. He was febrile to 38.4°C and his exam was notable for very large, erythematous tonsils. His labs were notable for a white blood cell (WBC) count of 119.8 K/cu mm (3.50–10.80 K/cu mm) with 91% blasts, creatinine elevated to 1.63 mg/dL (0.70–1.30 mg/dL), and lactate dehydrogenase (LDH) of 1122 U/L (≤250 U/L). Computed tomography (CT) of the neck was remarkable for the enlargement of tonsils and lymph nodes with a narrowing of the nasopharyngeal airway. He was started empirically on cefepime and transferred to a tertiary care intensive care unit (ICU) due to concern for impending airway compromise in the setting of likely new acute leukemia. Upon arrival, his peripheral blood smear was notable for numerous circulating blasts with a high nuclear to cytoplasmic ratio, a moderate amount of basophilic cytoplasm, open chromatin, and prominent nucleoli suggestive of monoblastic differentiation (Fig. 51.1). Flow cytometry confirmed an immunophenotype consistent with acute myeloid leukemia (AML).

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51.1 Assessment and Diagnosis

This young man had an emergent presentation of newly diagnosed acute myeloid leukemia with a high blast count, acute kidney injury, and significant upper airway edema. Beyond the medical challenges of remission induction, his risk for leukemia relapse depended on the results not immediately available, including his cytogenetics and molecular testing and then his response to first-line chemotherapy. These risk factors would later determine his post-remission therapy, including decisions about the intensity of chemotherapy and the use of bone marrow transplantation [1–3]. Thus, the possible impact of his leukemia therapy on future fertility was difficult to fully assess at initial presentation. However, the impact on his fertility was very likely to be considerable, and the topic of future fertility is often meaningful to an adolescent and young adult (AYA) patient, so it is important to discuss the potential impacts of therapy prior to starting whenever possible [4].

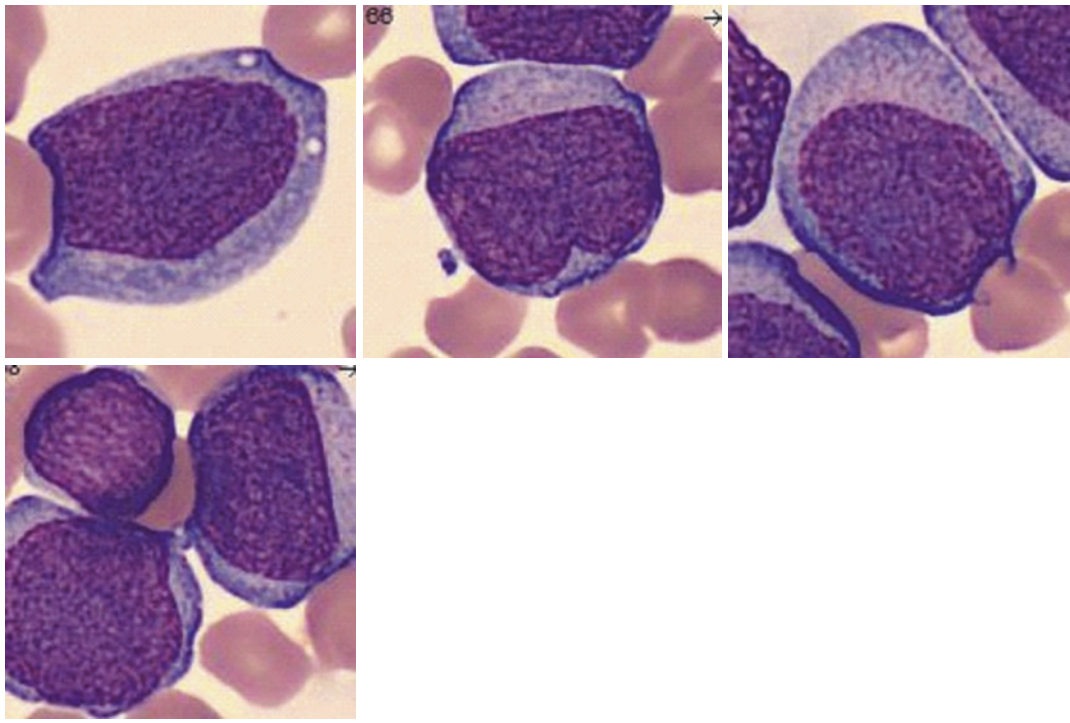

Fig. 51.1 Peripheral blood smear of circulating blasts notable for a high nuclear to cytoplasmic ratio, a moderate amount of basophilic cytoplasm, open chromatin, and prominent nucleoli

Current reports suggest that 25% of AYAs will attempt to preserve fertility before cancer treatment begins when offered the opportunity, although some of the major barriers to do so are that they do not know their fertility is at risk and there is not adequate time to pursue fertility preservation options [5].

AML is considered an oncologic emergency and outcomes have been found to be dependent on the time from diagnosis to treatment initiation in younger patients, necessitating that this patient start therapy as soon as possible to maximize outcomes [6]. Yet, he was not clinically stable enough to be referred to a fertility specialist nor to travel to a center where sperm cryopreservation could be performed. Initial treatment with cytarabine and an anthracycline was discussed with the patient, including the possible effects on future fertility. The patient expressed interest in fertility preservation prior to therapy initiation.

Unfortunately, there are not large randomized control trials published about the safety and efficacy of fertility preservation prior to the initiation of chemotherapy. There is a theoretical concern that leukemia cells could infiltrate reproductive organs, such as ovaries or testes, and then be transferred along with reproductive material. There is a large amount of observational data showing that a variety of fertility-preservation techniques can be performed safely in women, and there have been no reports of transferring leukemia [7]. There is less published experience with male fertility preservation, and though testicular leukemia is a well-described clinical entity, there have been large retrospective studies demonstrating safety and efficacy [8–10]. However, previous reports have established that sperm count is decreased in leukemia patients even in comparison to other cancers and chronic disease prior to therapy [10].

51.2 Management

Optimal timing for sperm cryopreservation before any therapy is given to maximize the quality and DNA integrity of the semen specimen, which can be damaged by just one round of chemotherapy [11]. Even though there is significant emotional stress and difficulty, it is important to discuss this at the time of diagnosis. However, less than 50% of people remember discussing fertility risks with their health care provider in some studies [12]. Ideally, this discussion would be held with a multidisciplinary team focused on providing patient education and providing fertility preservation procedures. These teams have become more common, particularly at institutions where there is expertise in caring for the AYA population with cancer.

This patient did have a discussion about the potential impact of therapy on his future fertility shortly after his diagnosis, and he desired to attempt fertility preservation if possible. Although he was not able to leave the hospital, he was clinically stable enough to manually provide semen for sperm cryopreservation, even in the ICU. A multidisciplinary approach was taken, and privacy was coordinated between nursing, social work, the ICU team, the hematologic malignancy team, and the patient's family. His father was able to transport the specimen immediately to the local lab for cryopreservation, and the patient was subsequently starting on induction chemotherapy.

Another option could have been testicular sperm extraction (TESE), which is called onco-TESE when used as an option for patients with cancer. Microdissection-TESE (micro-TESE) utilizes an operating microscope to identify small pockets or crypts of sperm production in comparison to tissue extraction done with TESE, which success depends on a higher level of spermatogenesis. It has been shown to increase yield in certain clinical settings with a similar clinical complication rate and decreased hematoma and testicular fibrosis [13]. It does, however, require sedation, so he was not eligible for this procedure due to upper airway edema and concern for respiratory compromise. In many situations though, this procedure could be coordinated with sedation used for other cancer diagnostic procedures.

51.3 Outcome

Patient was diagnosed with high-risk AML based on molecular markers and inadequate response to the initial conditioning therapy. He achieved a remission after re-induction therapy and underwent a matched unrelated donor hematopoietic stem cell transplant. Unfortunately, he was only able to bank 1.015 mL of semen with 0.07 million motile sperm (>20 million) and will establish care

with a fertility specialist in the future if procedures such as in vitro fertilization (IVF) or intrauterine insemination (IUI) are to be considered.

Clinical Pearls and Pitfalls

- The impact on fertility of antineoplastic therapy can be significant and impact the quality of life of patients undergoing therapy long after its completion.
- There are options for fertility preservation even in some of the more seriously ill patients.
- It is important to discuss these potential impacts early after diagnosis and ideally prior to initiating therapy.
- Multidisciplinary teams are encouraged, including fertility preservation specialists and other health care providers who care for AYAs with cancer.

Review Questions and Answers

Q1. What is NOT a barrier to preserving fertility for those with cancer requiring chemotherapy?
(a) Providers taking the time during a busy period to go over the risks to fertility
(b) Cost of fertility-preserving measures
(c) Medical status of the patient
(d) Importance of fertility preservation to patients
(e) Available facilities for fertility preservation

A1. (d)

Q2. True or false? There have been reports of transferring leukemia through egg or sperm preservation.

A2. False

Q3. What percentage of patients remembers discussing the impact of fertility of therapy with his/her provider?
(a) 10%
(b) 25%
(c) 50%
(d) 65%
(e) 90%

A3. (c)

Q4. What is the best option for a male patient who has reached sexual maturity but is unable to provide semen and still wishes to preserve fertility?
(a) Nothing
(b) TESE
(c) Sexual education
(d) Only offering fertility treatment following therapy

A4. (b)

Q5. True or false? Men with leukemia have decreased sperm counts in comparison to their healthy peers and to those of similar age with chronic diseases making sperm backing successfully more challenging.

A5. True

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