GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 9 (366) Сентябрь 2025

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

GEORGIAN MEDICAL NEWS
NO 9 (366) 2025

Содержание:

GEORGIAN MEDICAL NEWS
No 9 (366) 2025

CHARACTERISTIC OF MYELOID SARCOMA BY CANCER GENOME PROFILING AND ALGORITHM OF POTENTIAL BIOMARKERS FOR UTERINE MESENCHYMAL TUMOR

Takuma Hayashi[1]*, Kaoru Abiko[2], Ikuo Konishi[1,3].

[1]*Cancer Medicine, National Hospital Organization, Kyoto Medical Center, Kyoto, Kyoto 612-8555, Japan.*
[2]*Department of Obstetrics and Gynecology, Kanazawa University School of Medicine, Kanazawa, Ishikawa, 920-8641, Japan.*
[3]*Department of Obstetrics and Gynecology, Kyoto University School of Medicine, Kyoto, Kyoto 606-8507 Japan.*

Abstract.

Background: The patient experienced irregular bleeding and menstrual cycles and was receiving medical treatment and follow-up at a nearby women's clinic. However, the patient complained of vulvar discomfort; therefore, magnetic resonance imaging (MRI) was performed to investigate the cause. Imaging revealed a cervical mass, and the patient was referred to the Obstetrics and Gynecology Department of our general hospital. During the outpatient examination, our gynecologic staff noted significant swelling of the cervical lips. Furthermore, although the blood test results did not reveal any obviously high levels of tumor markers, the concentration of soluble interleukin-2 receptor (sIL-2R) was high at 4650 (U/mL). Therefore, pathological examination using a cervical biopsy was performed, and cervical sarcoma was suspected. Cervical carcinosarcoma or sarcoma is a rare tumor classified as an epithelial-mesenchymal mixed tumor. No established standard treatment exists for this tumor, and it has a poor prognosis. Contrast-enhanced computed tomography (CT) imaging and contrast-enhanced MRI were performed, and no obvious metastatic lesions were observed. **Methods:** A surgical treatment plan was established, and modified radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy were performed. To make a definitive diagnosis, surgical pathology was performed using surgically removed tissue and a diagnostic algorithm specific for uterine leiomyosarcoma. **Result:** Enlarged lymph nodes were observed, indicating pelvic lymph node metastasis. Based on the algorithm for uterine mesenchymal tumors established by the authors and the results of the surgical pathology examination of the tissue resected by surgical treatment, the patient's tumor was diagnosed as a myeloid sarcoma. Since the oncological properties of myeloid sarcoma are similar to those of acute myeloid leukemia (AML), the concentration of sIL-2R is elevated. Currently, treatment is the same as that for AML, consisting of induction therapy (daunorubicin + cytarabine) and consolidation therapy (high-dose cytarabine). To date, no recurrence of myeloid sarcoma was noted, and the patient is doing well. **Conclusion:** In cancer treatment, contrast-enhanced MRI is useful for identifying the size and location of tumor masses. However, contrast-enhanced MRI does not lead to the diagnosis of tumor masses. Therefore, early blood tests and tumor biopsy results are important for differential diagnosis and early treatment decisions.

Key words. Myeloid sarcoma, leiomyosarcoma, cervical tumor, acute myeloid leukemia.

Introduction.

Two types of uterine cancer are reported depending on the origin of the malignant tumor [1]. They are those originating in the endometrium of the uterine body and those originating in the uterine body [2]. Malignant tumors of the endometrium are composed of malignant cells with various morphologies [3]. According to the World Health Organization (WHO) classification of gynecological tumors, malignant tumors arising from the endometrium of the uterine body include endometrial cancer, endometrial stromal sarcoma, uterine carcinosarcoma, and uterine adenocarcinoma [4]. According to the WHO classification of gynecological tumors, tumors arising from within the uterine body include uterine mesenchymal tumors such as uterine leiomyoma and uterine leiomyosarcoma [5].

Cervical cancer that develops in the cervix can be classified into two types based on differences in cell morphology [6]. According to the WHO classification of gynecological tumors, two types exists: squamous cell carcinoma, which develops from squamous epithelial cells of the mucosal tissue at the entrance of the cervix, and adenocarcinoma, which develops from columnar epithelial cells of the glandular tissue near the body of the uterus [7]. The number of individuals with cervical cancer increases from their late 20s onwards, whereas the number of individuals with endometrial cancer increases after the age of 40 years [8]. In many cases, the location and size of a tumor in the body are determined from the results of imaging tests such as computed tomography (CT) imaging or contrast-enhanced magnetic resonance imaging (MRI); however, these imaging tests rarely lead to an accurate diagnosis of the tumor [9].

In this patient, the tumor, which was thought to have developed from the uterine body to the cervix, grew outside the uterine body within the pelvis and reached the Douglas pouch. Therefore, the mass did not appear to originate from the uterine or cervical endometrium. Therefore, our medical staff considered the possibility that the patient may have developed a uterine mesenchymal tumor originating from the smooth muscle layer of the uterus. Furthermore, contrast-enhanced MRI revealed that the tumor tended to grow rapidly. Since she was in her 50s when the disease first appeared, we considered the possibility that the tumor was a uterine leiomyosarcoma.

Therefore, we performed radical hysterectomy and bilateral salpingo-oophorectomy to remove the uterus, fallopian tubes, and ovaries. Molecular pathological analysis was performed on the uterine tissue, fallopian tubes, and ovaries removed during surgical treatment. High caveolin 1 expression has been

observed in mesenchymal tumors, including uterine leiomyomas and leiomyosarcomas [10]; however, no caveolin 1 expression has been observed in tumor tissues excised from patients. The concentration of soluble interleukin 2 receptor (sIL-2R) in the serum collected from the patient was 4650 (U/mL), which was high, raising the suspicion of a tumor in hematopoietic cells [11]. Immunohistochemical (IHC) staining showed that the excised tissue was positive for myeloid cells surface markers (MPO, CD68, CD117, and CD43) [12]. These results revealed the development of myeloid sarcoma, a malignant tumor primarily caused by bone marrow cells. Myeloid sarcoma is a type of acute myeloid leukemia (AML) blood cancer [13]. It often occurs simultaneously with AML or as a sign of AML recurrence after treatment. However, AML was not observed in this case.

In this case, we observed a tumor originating from the smooth muscle layer of the uterine body or cervix that grew into the Douglas pouch. Furthermore, contrast-enhanced MRI suggested the possibility of developing a malignant uterine mesenchymal tumor, that is, a uterine leiomyosarcoma. However, IHC results from the tumor tissue removed during surgical treatment confirmed the development of myeloid sarcoma. The patient had no history of AML or treatment, and the tumor extending from the uterine body or cervix to the Douglas pouch was diagnosed as myeloid sarcoma.

Materials and Methods.

Enhaced-MRI image examination:

Contrast-enhanced MRI (Vantage Centurian: Vantage Galan 3T MRT-3020, Canon Medical Systems, Inc., Ohtawara, Tochigi, Japan) was performed to identify the size and the location of the mass in the patient's body, Contrast-enhanced MRI imaging (Vantage Centurian: Vantage Galan 3T MRT-3020) can also reveal bleeding within the mass, but it is difficult to make a definitive diagnosis.

Laparoscopic surgery:

The modified radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy were performed via laparoscopic surgery (ENDOEYE FLEX 3D, Olympus Corporation, Shinjuku, Tokyo, Japan) and a surgical device (HICURA, Olympus Corporation), respectively, for surgical treatment of tumor surrounding the uterine body and cervix.

Histopathological examination:

A surgical pathologist performed histopathological analysis of the sections from formalin-fixed paraffin-embedded resected tissue to evaluated the gross findings and histopathological characteristics of the specimens [14]. Using the standard procedure, hematoxylin and eosin (H.E.) staining analyses were performed [14]. The entire brown 3,3'-Diaminobenzidine, tetrahydrochloride-stained tissues were scanned with a digital fluorescence microscope BZ-X800 by corporation recommended procedure (Keyence, Osaka, Osaka, Japan).

Immunohistochemistry:

Histological staining for caveolin-1, cyclin B, cyclin E1, Large Multifunctional Protease 2 (LMP2)/β1i, Ki-67, desmin, and myogenin was performed on serial tumor sections obtained from patients with uterine mesenchymal tumors and tissue sections obtained from tumors that wrap around the uterine corpus and cervix (Supplementary Material 1). Monoclonal antibodies against human cyclin E1 (clone CCNE1/2460) were purchased from Abcam (Cambridge Biomedical Campus, Cambridge, UK), and the monoclonal antibodies against Ki-67 (clone MIB-1) were purchased from Dako Denmark A/S (DK-2600 Glostrup, Denmark). Monoclonal antibodies against human desmin (clone RM234) and human myogenin (clone MGN185) were purchased from GeneTex, Inc. (Irvine, CA, USA). Monoclonal antibodies against human caveolin-1 (clone sc-53564), human cyclin B1 (clone sc-245), and human LMP2/β1i (clone sc-373689) were purchased from Santa Cruz Biotechnology Inc. (Santa Cruz, CA, USA). These antibodies have been used to diagnose mesenchymal tumors in humans. Anti-MPO (clone sc-390109), anti CD68 (clone sc-20060), anti CD117/c-kit (clone sc-365504), and anti CD43 (clone sc-21774) antibodies were purchased from Santa Cruz Biotechnology Inc. These antibodies have been used previously to diagnose myeloid sarcoma. All immunohistochemistry experiments were performed using the avidin–biotin complex method, as previously described [15,16]. Briefly, a representative 5 mm tissue section was cut from a paraffin-embedded radical hysterectomy specimen obtained from each patient with a uterine mesenchymal tumor. The sections were first incubated with a biotinylated secondary antibody (Dako, DK-2600 Glostrup, Denmark) and then with a streptavidin complex solution (Dako). The chemical reaction was developed using 3,39′-diaminobenzidine tetrahydrochloride hydrate (DAB; Dako), and the tissue slides treated with appropriate primary monoclonal antibody and biotinylated 2nd monoclonal antibody were counterstained with hematoxylin. Normal myometrial portions of the specimens were used as positive controls. Tissue sections incubated with normal rabbit immunoglobulin G instead of the primary antibody were used as the negative controls. Brown DAB staining reveals the expression of cyclin E and Ki-67. Normal rabbit or mouse antisera were used as negative controls for primary antibodies. The DAB-stained tissues were scanned using a digital microscope by corporation recommended procedure (BZ-X800; Keyence Corporation, Osaka, Japan). Brown dots indicate expression levels of cyclin E, Ki-67 and other candidate molecules. Normal rabbit or mouse antisera (Santa Cruz Biotechnology Inc.) were used as negative controls for primary antibodies.

Pathogenic variants of patient’s tumor and human uterine leiomyosarcomas:

Pathogenic variants (PVs) of the patient’s tumor and human uterine leiomyosarcomas were identified using the FoundationOne® CDx tissue examination (Foundation Medicine, Inc., Cambridge, MA, USA) with patient tissues resected via surgical treatment. Cancer genome profiling using FoundationOne® CDx tissues is covered by health insurance.

Standard treatment for acute myeloid leukemia (AML): Treatment of patients with myeloid sarcoma with CP X-351 (daunorubicin/cytarabine encapsulated liposomes)

CPX-351 is a liposomal formulation of cytarabine and daunorubicin used for AML [17]. The standard therapy for AML

is a combination of cytarabine and daunorubicin. The standard doses of these drugs are 100–200 mg/m2 for consecutive 7 days, and 45 mg/m2 for three injections in older adult patients.

Ethics approval and consent to participate:

Shinshu University approved the experiments (Approval No. M192). All experiments using human tissues were conducted at the National Hospital Organization, Kyoto Medical Center (approval no. NHO H31-02), in accordance with the institutional guidelines issued on August 17, 2019, by the Central Ethics Review Board of the National Hospital Organization Headquarters (Tokyo, Japan) and Shinshu University (Nagano, Japan). The authors attended educational lectures on medical ethics in 2020 and 2021, supervised by the Japanese government (completion numbers AP0000151756, AP0000151757, AP0000151769, and AP000351128). Consent for participation in this clinical study was obtained from all the patients. After being briefed on the clinical study and agreeing to the clinical research objectives, the participants signed consent forms. The authors attended seminars on the ethics of experimental research using small animals on July 2, 2020, and July 20, 2021. The code number for ethical approval of experiments with small animals was KMC R02-0702.

Results.

A woman in her 50s with a history of endometrial hyperplasia visited the gynecology department of a nearby clinic for outpatient treatment due to irregular bleeding and menstrual irregularities. However, during follow-up at our clinic, she experienced genital discomfort; therefore, a contrast-enhanced MRI was performed. Contrast-enhanced MRI revealed a cervical mass. Consequently, in December 2021, she was referred by her doctor to our gynecology department at a general hospital for further examination and treatment of the cervical mass. Examination at the outpatient clinic revealed a prominent mass on her cervical lip. Macroscopic examination of the cervix revealed no abnormalities in the uterine mucosa. Therefore, contrast-enhanced CT and MRI scans were performed. The results of imaging tests indicated that her illness was most likely due to a submucosal stromal lesion, such as a uterine sarcoma. We performed a cervical biopsy, and the pathological results were suggested uterine sarcoma. Therefore, after discussion at a medical conference, the decision was made to surgically remove the tumor. In January 2022, modified radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy were performed. Surgical pathology was performed on surgically removed tissues.

Contrast-enhanced MRI imaging results:

A tumor was observed occupying the area from the urethra to the bladder wall and from the vagina to the uterine vagina. Contrast-enhanced MRI T2W1 imaging results showed a homogeneous, moderate signal (Supplementary Figure 1A). In addition, chronic compression fractures of the thoracic and lumbar spines were observed. Contrast-enhanced MRI (DW1) revealed severe diffusion restriction (Supplementary Figure 1B). Based on the extent of the lesion and signal, the mass was considered to be either a uterine leiomyosarcoma or malignant lymphoma. The rectum was compressed by the mass. However, no evidence of tumor invasion was observed in the rectal wall. Bilateral hydronephrosis and hydroureter formation occurred due to tumor progression. Left ureteral stones, left kidney stones, and left kidney atrophy were observed. Lymphadenopathy was not observed.

Blood test results:

When a malignant tumor develops in the digestive organs, the serum concentrations of the tumor markers Carcinoembryonic Antigen (CEA) and Carbohydrate Antigen 19-9 (CA19-9) increase [18]. When a malignant tumor develops in gynecological organs (ovaries, fallopian tubes, or uterus), the serum concentration of the tumor marker Carbohydrate Antigen 125 (CA125) increases [19]. However, no diagnostic markers malignant uterine mesenchymal tumors (i.e., uterine leiomyosarcoma) were identified (Supplementary Table 1). Blood test results revealed normal levels of the tumor markers, CEA, CA19-9, and CA125. Therefore, the occurrence of malignant tumors in the digestive or female organs (ovaries, fallopian tubes, and uterus) was excluded. In contrast, the serum sIL-2R concentration was 4650 (U/mL), which was high (normal value is 212 or higher but less than 613) (Supplementary Table 1). Diseases that may cause high levels of sIL-2R include malignant lymphoma, lymphocytic leukemia, Adult T-cell leukemia (ATL), hemophagocytic syndrome, interstitial pneumonia, and collagen diseases such as rheumatoid arthritis.

Surgical pathology results and cancer genome profiling (CGP):

1. At the time of initial onset, myeloid sarcoma is often accompanied by malignant myeloid tumors such as AML. However, AML was not detected in this patient. The image shows the macroscopic appearance of a tumor in the cervical tissue. Subendometrial tumors are circled in white dotted lines. The tumor has grown from the uterine body to the cervix (Supplementary Figure 1C, D).

2. Metastatic lesions of the myeloid sarcoma were observed in the pelvic lymph nodes.

3. The surgical pathological diagnosis performed in this case did not reveal any findings suggesting the development of benign tumors (leiomyoma) or malignant uterine mesenchymal tumors, such as uterine leiomyosarcoma (Figure 1 A, B, Supplementary Table 2).

4. In uterine mesenchymal tumors (uterine leiomyosarcoma), caveolion 1 expression is strong, but the expression of LMP2/β1i is extremely weak or undetectable [20,21] (Figure 1B, Supplementary Table 2). However, in tumor tissues obtained from patients following surgical treatment, the expression of caveolin 1 was significantly weak, whereas the expression of LMP2/β1i was strong. Based on these results, the patient did not develop a uterine mesenchymal tumor [22] (Figure 2 A, B).

5. Analysis of cell surface markers: Myeloid cell surface markers (myeloperoxidase (MPO), Cluster Designation 68 (CD68), CD117, and CD43) were all positive (Figure 2B). Based on the results of this pathological test, the tumor was diagnosed as a myeloid sarcoma.

6. Genetic analysis has shown that most patient of AML has nucleophosmin 1 (NPM1) and c-KIT/ CD117 mutations. Based on the results obtained from FoundationOne® CDx,

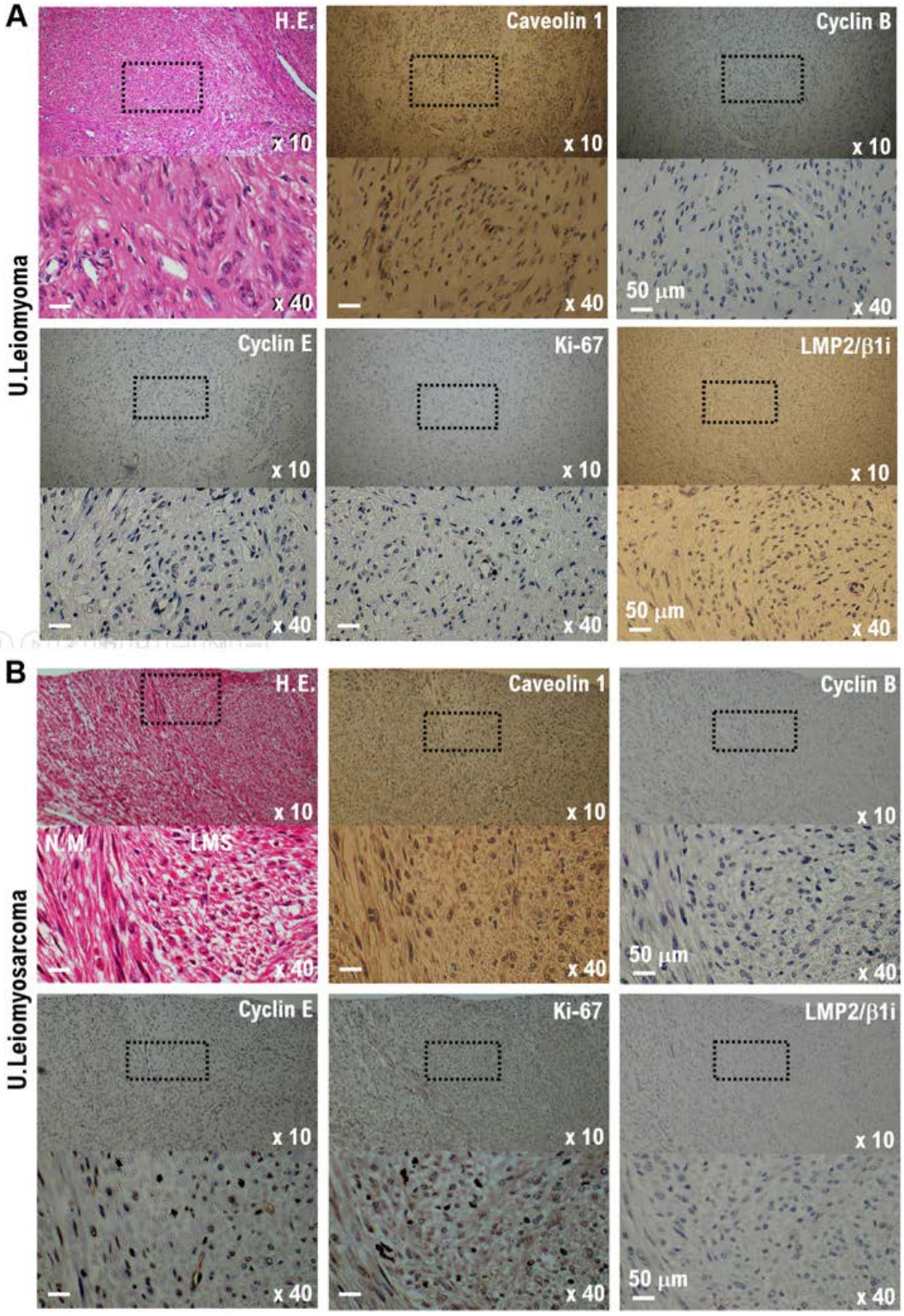

Figure 1. *As cells of uterine mesenchymal tumors have various cell and nuclear morphologies, surgical pathological diagnosis is often challenging. Therefore, biomarkers specific to various tumors were searched for using tissues of uterine mesenchymal tumors removed by surgical treatment. Consequently, five factors, caveolin1, cyclin B, cyclin E, Ki-67, and LMP2/β1i, were identified as candidate biomarkers for uterine mesenchymal tumors. A. The expression of five candidate factors was examined using immunohistochemistry (IHC) in 102 cases of uterine leiomyoma (57 cases of ordinary leiomyoma and 45 cases of cellular leiomyoma), a benign tumor of uterine mesenchymal tumors. Strong expression of caveolin 1 and LMP2/β1i was observed in uterine leiomyoma. Weak expression of cyclin B, cyclin E, and Ki-67 was observed in uterine leiomyoma. B. Expression status of five candidate factors was shown using immunohistochemical staining in 151 cases of uterine leiomyosarcoma, a malignant tumor of the uterine mesenchymal tumor. Uterine leiomyosarcoma showed strong expression of caveolin 1, cyclin B, cyclin E, and Ki-67, whereas LMP2/β1i showed weak expression.*

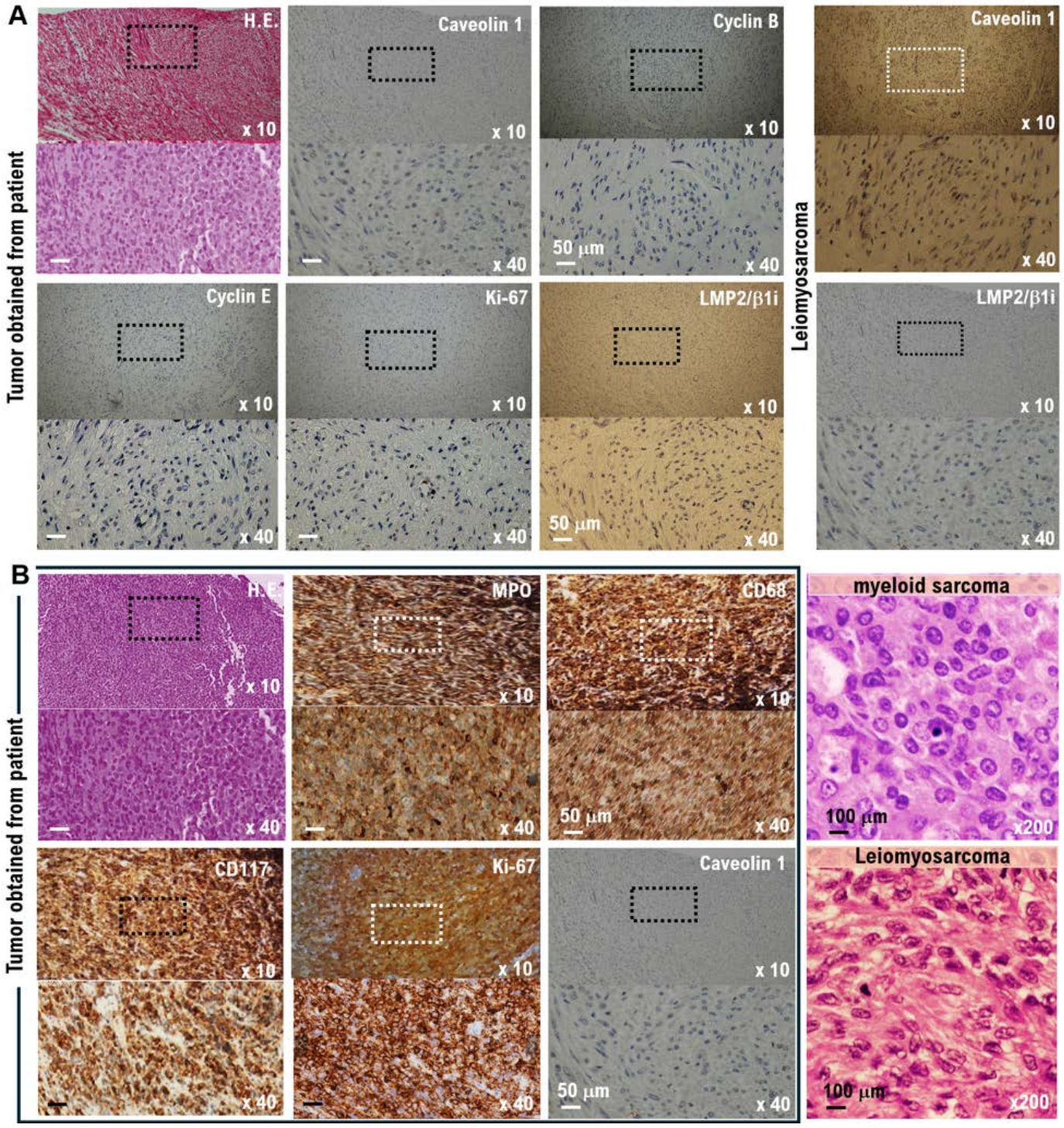

Figure 2. *Based on the results of previous clinical studies, five factors, caveolin1, cyclin B, cyclin E, Ki-67, and LMP2/β1i, have been identified as candidate biomarkers for uterine mesenchymal tumors. The expression status of the five candidate factors was determined using immunohistochemical staining (IHC) of tumor tissues that developed in the cervical tissue. Strong expression of Ki-67 and LMP2/β1i was observed in tumor tissues that developed in the cervical tissue.*

Furthermore, compared to uterine leiomyoma, strong expression of cyclin E was observed in tumor tissues that developed in the cervical region. Furthermore, compared to uterine leiomyoma, strong expression of cyclin E was observed in tumor tissues that developed in the cervical region. Strong expression of MPO, CD68, CD117, and Ki-67 was observed in tumor tissues arising from the uterine cervix, whereas caveolin 1, a biomarker for uterine mesenchymal tumors, was not expressed. The two images on the right are Hematoxylin Eosin (HE) images of myeloid sarcoma and uterine leiomyosarcoma. Although they vary slightly depending on the case, the cellular and nuclear morphologies of myeloid sarcomas are similar to those of uterine leiomyosarcomas.

Table 1. *Cancer Genome Profiling of the tumor obtained from patient and uterine leiomyosarcin.*

Results from FoundationOne CDx tissue with tumor obtained from patient

Tumor Obtained from Patient	Genome status	Results
	Microsatellite status	**Stable**
	Tumor mutation burden (TMB)	**6 Muts/Mb**
	LOH	**1.3%**
	Pathogenic variants	***KRAS G12D*** **(VAF 35.9%),** ***NPM1 Q289M*** **(VAF 43.2%),** ***TP53*** **t211l (VAF 45.3%),** ***RUNX1-RUNX1T1*** **rearrangement (VAF 43.6%)**
	Proposed Antitumor Agents	***KRAS G12C*** **Sotorasib**

Possible pathogenic variants of uterine leiomyosarcoma

Uterine Leiomyosarcin	Genome status	Results
	Microsatellite status	**Stable**
	Tumor mutation burden (TMB)	**4 Muts/Mb**
	LOH	**2.1%**
	Pathogenic variants	***ATRX*** **K242* (VAF 32.9%), Rb M605fs*48 (VAF 35.7%),** ***PTEN*** **loss,** ***CDKN2A*** **loss**
	Proposed Antitumor Agents	***CDKN2A*** **loss Palbociclib Abemaciclib**

VAF: Variant Allele Frequency.

NPM1 Q289M was detected as pathogenic variant (Table 1). The results of cancer gene panel testing FoundationOne CDx using tumor tissue obtained from patients indicate a pathogenic variant specific to myeloid sarcoma but differ from the pathogenic variant specific to uterine leiomyosarcoma (Table 1). The results of cancer gene panel testing FoundationOne® CDx using tumor tissue obtained from patients indicate CPG of myeloid sarcoma (Table 1).

Based on the surgical pathological diagnosis of the surgically removed tissue, the patient was diagnosed with myeloid sarcoma and underwent induction therapy with CPX-351 (daunorubicin + cytarabine liposome) and maintenance therapy (high-dose cytarabine), which are the standard treatments for AML [23]. Subsequent contrast-enhanced MRI showed no progression of the malignant tumor, and the patient remained in remission with standard treatment regimen. Subsequently, the patient was not administered antitumor drugs and was monitored.

Discussion.

A woman in her 50s with a history of endometrial hyperplasia visited the gynecology department of a nearby clinic for outpatient treatment of abnormal bleeding and irregular menstrual cycles. However, during follow-up at this clinic, she reported genital discomfort; therefore, contrast-enhanced MRI was performed. Contrast-enhanced MRI suggested a submucosal uterine sarcoma of the cervix. However, blood tests revealed high serum sIL-2R concentrations. The patient underwent a modified radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy via laparoscopic surgery (ENDOEYE FLEX 3D). Furthermore, the surgical pathological diagnosis of tumor tissues removed by surgical treatment revealed tissues with characteristics of myeloid sarcoma.

In this case, AML did not develop; however, one year after surgical treatment, the patient experienced lower abdominal and lower back pain, so imaging studies were performed. The imaging results showed clinical evidence of myeloid sarcoma recurrence. The patient therefore underwent induction therapy with CPX-351 (daunorubicin + liposomal cytarabine), a standard treatment for AML, followed by maintenance therapy (high-dose cytarabine) [23]. Tumor had shrunk, confirming the effectiveness of standard treatment with CPX-351 and maintenance therapy. If a recurrence is confirmed again, our medical staff will consider treatment with a bone marrow transplant. If a recurrence is confirmed again, our medical staff will consider treatment with a bone marrow transplant. The biological characteristics of malignant tumors vary from patient to patient. Therefore, treatment for myeloid sarcoma must be tailored to the specific characteristics of the tumor.

As mentioned earlier, many studies recommend chemotherapy before the onset of AML, and our medical team is currently treating a patient with primary cervical myeloid sarcoma. This study showed a tendency to prevent AML onset. In this case, chemotherapy may have prevented the development of AML. Primary myeloid sarcoma of the cervix is extremely rare, but primary myeloid sarcoma may develop into AML and has a poor prognosis. Therefore, careful follow-up is necessary, even if AML does not develop.

Conclusion.

In cancer treatment, contrast-enhanced MRI is useful for identifying the size and location of tumor masses. However, contrast-enhanced MRI does not lead to the diagnosis of tumor masses. Therefore, early blood tests and tumor biopsy results are important for differential diagnosis and early treatment decisions.

Ethical considerations.

Institutional Review Board (IRB) Approval and Consent to Participate: This research on human cancer genome information derived from results of cancer genome profiling was conducted by Cancer Genomic Medicine Members at the Kyoto University Hospital, its affiliated hospitals, and the National Hospital Organization Kyoto Medical Center in accordance with institutional guidelines (IRB approval no. 50-201504, NHOKMC-2023-2, and H31-cancer-2). All patients received an explanation of the clinical trial and provided informed consent to participate in this study. Clinical research conducted by us complies with the Declaration of Helsinki.

Ethics committee name: IRB of the National Hospital Organization Headquarter (Meguro, Tokyo, Japan, approval code: H31-cancer-2; approval date: November 09, 2019, and August 14, 2025).

Ethics committee name: IRB of Kyoto University Hospital (Kyoto, Kyoto, Japan, approval code: R34005; approval date: August 01, 2025).

Ethical compliance with human study.

This study involves human subjects and has been approved by the ethics committee and IRB (Institutional Review Board) of the institution to which it is affiliated. This paper contains personally identifiable personal and/or medical information, as well as case reports/medical histories. Therefore, in accordance with our anonymization policy, it has been sufficiently anonymized to prevent the identification of individual patients. The authors obtained consent directly from the patients.

The authors attended research ethics education through the Education for Research Ethics and Integrity (APRIN e-learning program (eAPRIN)) agency. The completion numbers for the authors are AP0000151756, AP0000151757, AP0000151769, and AP000351128.

This study involves research with human materials and was approved by the institutional ethics committee(s) and IRBs (Ethics Committee for research with animals in National Hospital Organization Headquarter; Meguro, Tokyo, Japan).

Ethics committee name: IRB of the National Hospital Organization Headquarters (approval code: H31-1-2; approval date: November 09, 2019, and June 17, 2023, approved code: R07-1-2).

Conflicts of Interest.

Authors have nothing to disclose.

Author Contributions.

TH and KA reviewed the content of the case reports and selected the images obtained from the contrast-enhanced MRI examinations. TH, KA, and IK compiled the patient's medical history and chief complaints. TH, KA, and IK were the attending physicians and reviewed the case report and blood test results. IK reviewed the draft case report.

Funding: The costs of conducting our clinical research are covered by the following research grants: Japan Society for Promoting Science for TH (no. 19K09840), START-program Japan Science and Technology Agency (JST) for TH (no. STSC20001), National Hospital Organization Multicenter Clinical Study for TH (grant no. 2019-Cancer in general-02), and Japan Agency for Medical Research and Development (AMED) (no. 22ym0126802j0001), Tokyo, Japan. These research funds were provided by Japanese government research institutes, and therefore the funders were not involved in the establishment of the clinical research program, the collection and analysis of data, the public dissemination of research findings, or the preparation of the manuscript.

Data Availability Statement: The data are available and publicly available on various websites. Details are provided in the first paragraph of the Results section. Information from this clinical study and the associated transparency statement in the medical journal article are available online.

https://kyoto.hosp.go.jp/html/guide/medicalinfo/ clinical research/expand/gan.html (accessed on 15 March 2025).

Informed Consent Statement.

This research includes clinical/human materials, therefore Informed consent is required.

Acknowledgments.

The authors want to thank Dr. Kohji Moriyoshi at the pathology division, National Hospital Organization, Kyoto Medical Center. The authors also want to acknowledge all clinical staff for clinical research at Kyoto University Hospital and the National Hospital Organization Kyoto Medical Center. We also appreciate Dr. Keita Idegami, Chugai Pharma Manufacturing Co., Ltd. (Kitaku, Tokyo, Japan) and Sysmex Corporation. (Kobe, Hyogo, Japan) for providing medical information.

REFERENCES

1. WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 6.
2. WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 7-8.
3 WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 130-137.
4. Tokinaga A, Furuya M, Niino H, et al. Colonic low-grade endometrial stromal sarcoma and orthotopic endometrial stromal tumor with limited infiltration sharing the JAZF1-SUZ12 gene fusion. Pathol Int. 2014;64:178-182.
5. Uterine leionmyoma. WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 272-282.
6. Uterine leiomyosarcoma. WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 283-285.
7. WHO Classification of rumors of the uterine corpus. Female Genital Tumors. WHO Classification of rumors 5th Edition Edited by WHO classification of tumours editorial board. 266.
8. Sponchiado M, Liao YS, Reznikov LR. Identification of cholinergic cells with chemosensory traits in the porcine uterus. Cell Tissue Res. 2022;388:33-47.
9 Söylemez MS, Kemah B, Söylemez UPO, et al. Endometrial adenocarcinoma recurrence presenting with tibial metastasis: Report of a case. Int J Surg Case Rep. 2017;36:15-17.
10. Yan PF, Yan L, Zhang Z, et al. Accuracy of conventional MRI for preoperative diagnosis of intracranial tumors: A retrospective cohort study of 762 cases. Int J Surg. 2016;36:109-117.
11. Hayashi T, Ichimura T, Yaegashi N, et al. Expression of CAVEOLIN 1 in uterine mesenchymal tumors: No relationship between malignancy and CAVEOLIN 1 expression. Biochem Biophys Res Commun. 2015;463:982-7.
12. Maes M, Stevens W, Scharpé S, et al. Seasonal variation in peripheral blood leukocyte subsets and in serum interleukin-6,

and soluble interleukin-2 and -6 receptor concentrations in normal volunteers. Experientia. 1994;50:821-9.
13. Liu Y, Zhang Y, Xie J, et al. Correlation analysis between LINC00324 and immunophenotype in peripheral blood leukocytes in patients with acute myeloid leukemia. Xi Bao Yu Fen Zi Mian Yi Xue Za Zhi. 2019;35:832-837.
14. Lapadat R, Tower RL 2nd, Tam W, et al. Pure Erythroid Leukemia Mimicking Ewing Sarcoma/Primitive Neuroectodermal Tumor in an Infant. Pediatr Blood Cancer. 2016;63:935-7.
15. Tanabe Y, Hayashi T, Okada M, et al. POTENTIAL DIAGNOSTIC BIOMARKERS FOR HUMAN MESENCHYMAL TUMORS, ESPECIALLY LMP2/B1I AND CYCLIN E1/MIB1 DIFFERENTIAL EXPRESSION: PRUM-IBIO STUDY. Georgian Med News. 2024;350:42-48.
16. Hayashi T, Sano K, Okada M, et al. Hereditary Gastric Cancer Is Linked with Hereditary Breast and Ovarian Cancer. World J Oncol. 2024;15:722-730.
17. Hayashi T, Sano K, Okada M, et al. Efficacy and Tolerability of Olaparib Plus Paclitaxel in Patients with Gastric Cancer Associated with Hereditary Breast and Ovarian Cancer. Curr Oncol. 2024;31:6723-6734.
18. Alzahrani AM, Alnuhait MA, Alqahtani T. The Clinical Safety and Efficacy of Cytarabine and Daunorubicin Liposome (CPX-351) in Acute Myeloid Leukemia Patients: A Systematic Review. Cancer Rep (Hoboken). 2025;8:e70199.
19. Romanowicz A, Łukaszewicz-Zając M, Choromańska B, et al. A Disintegrin and Metalloprotease 15 (ADAM15) as a Potential Predictor of Distant Metastasis in Colorectal Cancer (CRC). J Clin Med. 2025;14:5082.
20. Abul Rub F, Moursy N, Alhedeithy N, et al. Modern Emerging Biosensing Methodologies for the Early Diagnosis and Screening of Ovarian Cancer. Biosensors (Basel). 2025;15:203.
21. Matsumoto Y, Hayashi T, Amano Y, et al. DEVELOPMENT OF ENDOSALPINGIOSIS IN PATIENTS WITH A HISTORY OF BREAST CANCER. Georgian Med News. 2024;355:72-76.
22. Nishikawa S, Hayashi T, Amano Y, et al. Characteristic of Concurrent Uterine Lipoleiomyoma and Hemangioma by Algorithm of Candidate Biomarkers for Uterine Mesenchymal Tumor. Diagnostics (Basel). 2022;12:2468.
23. Mavridou K, Gavriil S, Papoudou-Bai A, et al. Isolated cutaneous myeloid sarcoma preceding acute myeloid leukemia: a case report and literature review. Dermatol Reports. 2025;17:10013.