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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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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.

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PIGMENTED VILLONODULAR SYNOVITIS IN THE ANKLE OF A PEDIATRIC PATIENT: A CASE REPORT

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Abstract.

Background: Pigmented villonodular synovitis (PVNS), also known as diffuse tenosynovial giant cell tumor, is a rare, benign but aggressive synovial proliferative disorder. It most commonly affects the knee; involvement of the foot and ankle is uncommon (incidence ~1.8 per million), and pediatric cases are especially rare. This rarity often leads to delayed diagnosis, as early symptoms can mimic benign causes (e.g. sprains or "growing pains") and initial radiographs may be unremarkable.

Case Presentation: We report a case of a 12-year-old girl with a four-year history of chronic ankle pain and swelling. She had been misdiagnosed with growth-related pain or recurrent ankle sprains after undergoing multiple X-ray examinations that showed no abnormalities. Over time, a progressive ankle joint swelling and pain with restricted motion developed. On examination, she had tenderness over the ankle (medially and laterally) with limited range of motion; neurovascular status was intact. Laboratory work-up showed a normal white blood cell count and an elevated erythrocyte sedimentation rate (ESR of 30 mm/hour, normal <20), consistent with mild inflammation. Plain radiographs remained normal, but MRI revealed diffuse synovial thickening with confluent nodular masses in the anterior and posterior ankle joint recesses, with heterogeneous signals and minor bone erosion, suggestive of PVNS. Arthroscopic biopsy confirmed tenosynovial giant cell tumor (PVNS). The patient underwent an open synovectomy via combined anterior and posterolateral incisions (double incision) to achieve maximal synovial resection. Approximately six weeks post-operatively, a single-session adjuvant radiosynoviorthesis (RSO) was performed – an intra-articular injection of Yttrium-90 colloid (approximately 5 mCi) – to irradiate any remaining synovial tissue and reduce recurrence risk. Postoperatively, her pain improved with no immediate complications. At 12-month follow-up, the patient had no evidence of recurrence and demonstrated marked improvement: her ankle pain resolved (VAS pain score improved from 6/10 preoperatively to 0–1/10 post-treatment) and range of motion normalized (dorsiflexion 20° and plantarflexion 45°, restored from a preoperative ~50% limitation). She returned to full, pain-free weight-bearing ambulation without assistive devices.

Conclusion: PVNS of the ankle is a challenging diagnosis in children due to its rarity and nonspecific presentation. This case highlights that persistent pediatric ankle pain with swelling, even with normal initial X-rays, should raise suspicion for uncommon pathologies like PVNS. Early MRI is warranted for definitive diagnosis. Complete surgical synovectomy remains the primary treatment for diffuse PVNS; however, adjuvant intra-articular RSO (radioisotope synovectomy) can be safely utilized to minimize the high recurrence risk associated with diffuse disease. Our patient's excellent outcome at one year – with restored function and no recurrence – underscores the effectiveness of an aggressive combined approach in managing diffuse PVNS of the ankle in a pediatric patient.

Key words. Pigmented villonodular synovitis, tenosynovial giant cell tumor, ankle, pediatric, synovectomy, radiosynoviorthesis, radiation synovectomy, case report.

Introduction.

PVNS of the ankle is a very rare, locally aggressive proliferative synovial condition of unknown etiology [1-7]. The knee is the most commonly affected joint, while foot and ankle involvement is uncommon (estimated ~1.8 cases per 1,000,000 population) [2,8]. PVNS can occur in localized or diffuse forms; the diffuse type involves the entire synovium and tends to be more aggressive and destructive than the localized nodular form [9,10]. First described in 1941 by Jaffe et al., PVNS is benign but can cause severe joint erosions and bone destruction if untreated [11,12]. It typically affects adults aged 30–40, and pediatric cases are exceedingly uncommon [13].

Clinically, PVNS often presents with chronic joint pain, swelling, and stiffness. In children and adolescents, such symptoms are easily mistaken for more common issues. Indeed, in pediatric ankle pain, diagnoses like ankle sprain/strain or "growth pain" are often presumed, and a rare entity like PVNS may be initially overlooked in the differential diagnosis. Additionally, early PVNS may not show abnormalities on plain X-rays, which further contributes to diagnostic delay. In a recent multicenter study, the median delay from symptom onset to PVNS diagnosis was 18 months [14,15]. In our patient's case, diffuse ankle PVNS went undiagnosed for four years due to such factors.

Magnetic resonance imaging (MRI) is the most sensitive tool for early detection, often showing characteristic synovial proliferation with low to intermediate T1 and heterogeneous T2 signals with hemosiderin deposition [16,17]. Definitive diagnosis is confirmed by histopathology.

The mainstay of treatment for diffuse PVNS is complete synovectomy, either via arthroscopic or open surgery [18]. An open surgical approach often achieves a more extensive synovectomy (especially for diffuse or extra-articular disease) and is associated with lower recurrence rates in diffuse PVNS, albeit with more surgical morbidity [19]. Arthroscopic synovectomy, while minimally invasive, can be effective for accessible localized lesions but may risk higher recurrence if any diseased tissue remains. Recurrence rates after surgery alone are substantial – reported between ~40% up to 60% or higher for diffuse disease in some series. Therefore, adjuvant therapies are often considered. External beam radiotherapy and intra-articular radiosynoviorthesis (RSO) with beta-emitting radioisotopes (often Yttrium-90) have been used as

adjuncts to surgery to reduce recurrence [3]. Yttrium-90 (^90Y) radiosynovectomy is commonly employed, especially in the United States, for large joints like the knee [3]. It delivers high-energy β-radiation (mean penetration ~3–5 mm) to ablate remaining synovium. For smaller joints (ankle, subtalar), some protocols use lower-energy isotopes (e.g. Rhenium-186 or Erbium-169) to minimize soft tissue damage. We present this pediatric ankle PVNS case to emphasize the importance of early recognition and to describe our surgical and adjuvant treatment approach, including open synovectomy and postoperative RSO, which led to a successful outcome.

Case Presentation.

A 12-year-old girl presented with a four-year history of right ankle pain and intermittent swelling, exacerbated by walking. Initially, her symptoms were mild and attributed to benign causes; over the years she underwent multiple clinical evaluations and X-ray examinations, which were all unremarkable, leading to diagnoses of ankle sprain/strain or "growth pains." However, her ankle swelling gradually and persistently increased. By the time of referral to our clinic, she reported daily ankle pain (intensity ~6/10 on walking), noticeable swelling, and reduced range of motion. There was no history of significant trauma and no family history of rheumatologic disease or tumors.

On examination, there was a diffuse swelling around the ankle joint, with tenderness along both the lateral and medial aspects. Ankle motion was limited (dorsiflexion and plantarflexion were painful and approximately half of normal range). There were no signs of infection; the overlying skin was normal and the joint was stable. Neurovascular status of the foot was intact. Laboratory tests showed a normal white blood cell count. However, the erythrocyte sedimentation rate (ESR) was markedly elevated at 30 mm/hour (normal <20 mm/hour), consistent with moderate inflammation; this is in line with literature reports that about 45–50% of PVNS patients can have an elevated ESR [1]. C-reactive protein was within normal limits.

Plain radiographs of the ankle (Figure 1) remained essentially normal, with no osseous erosions, spurs, or periarticular soft tissue calcifications. Given the persistent symptoms, an MRI was obtained. The MRI of the ankle (Figure 2) revealed diffuse synovial thickening and proliferation throughout the tibiotalar and subtalar joints. There were multiple confluent nodular synovial masses in the anterior and posterior recesses of the ankle. The lesions exhibited low-to-intermediate signal intensity on T1-weighted images and heterogeneous high signal intensity on proton density and T2-weighted images, with some foci of low signal on all sequences (consistent with hemosiderin deposition). A subtle cortical erosion was noted at the anterior aspect of the talar body. The flexor hallucis longus tendon sheath was involved by ill-defined lobulated synovial tissue with similar signal characteristics. Mild joint effusion was present in the ankle and subtalar joints, and a small amount of fluid in the retrocalcaneal bursa suggested mild bursitis.

These imaging findings were highly suggestive of diffuse PVNS (tenosynovial giant cell tumor). An ultrasound-guided synovial biopsy was performed on January 28, 2023, yielding grayish-brown synovial tissue. Histopathological examination confirmed features of pigmented villonodular synovitis (diffuse-type tenosynovial giant cell tumor), with typical synovial villi, mononuclear cell proliferation, hemosiderin-laden macrophages, and multinucleated giant cells.

Figure 1. *Ankle X-ray (AP view) showing no bony erosions or notable soft tissue swelling.*

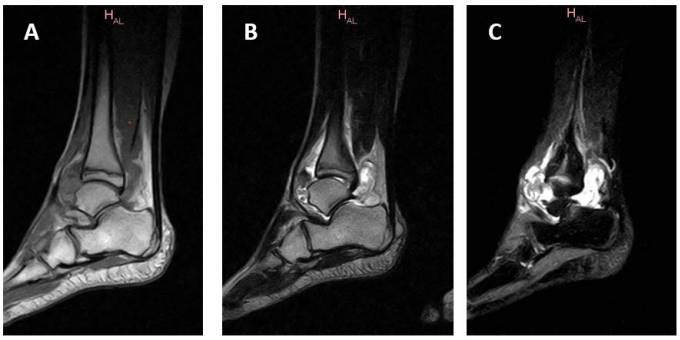

Figure 2. *MRI of the right ankle: (A) Proton density fat-sat image showing synovial hypertrophy with nodular lesions (white arrows) in the anterior ankle joint; (B) T2-weighted image showing posterior ankle joint with low-signal deposits (arrowheads) consistent with hemosiderin within hypertrophic synovium (white arrows indicate extent of synovial proliferation).*

Figure 3. *Intra-operative photograph of the right ankle showing the two incisions (anteromedial and posterolateral, marked by ''*'') used for open synovectomy in this diffuse PVNS case.*

Given the diffuse involvement of the ankle joint, complete resection via a single incision was not feasible. On March 19, 2023, the patient underwent surgery consisting of an open synovectomy through two approaches (an anteromedial ankle

incision and a posterolateral incision) to access and resect all affected synovial tissue. Intra-operatively, hypertrophic brownish synovium was observed in both anterior and posterior compartments; a meticulous open synovectomy (debridement) was performed, removing all visible diseased tissue (marginal resection). There were no immediate complications from surgery.

Post-operatively, the patient's ankle pain improved significantly. She was kept non-weight-bearing in a splint initially and started on gentle range-of-motion exercises in the first 2 weeks. At approximately 6 weeks after surgery, once the surgical wounds had healed, we administered adjuvant radiation synovectomy (RSO). Under fluoroscopic guidance, an intra-articular injection of a beta-emitting radioisotope was given to eradicate any residual microscopic synovium. Specifically, we utilized Yttrium-90 (^90Y) citrate colloid, which is commonly used for RSO in large joints [3]. A single dose of ~5 mCi (≈185 MBq) ^90Y was injected into the ankle joint (a dose on the lower end of the spectrum, adjusted for a smaller joint space). Triamcinolone acetonide (20 mg) was co-injected to mitigate post-injection inflammation. The patient's leg was immobilized for 48 hours post-RSO to allow the radionuclide to concentrate in the synovium. No immediate complications occurred; specifically, there were no signs of extra-articular leakage (confirmed by post-injection Bremsstrahlung imaging) and no skin or soft tissue reactions.

By the 6-week post-operative visit (just prior to RSO), the patient's ankle pain had already decreased (VAS 2–3/10 at that time) and her range of motion was improving with physical therapy. At final follow-up 12 months after surgery, she was doing well: the patient reported minimal to no pain in the ankle (VAS 0–1/10) and had regained full ankle motion compared to the contralateral side. She had returned to all normal activities and sports without limitations. Weight-bearing gait was normal, and no assistive devices were needed. Follow-up MRI at one year showed no evidence of PVNS recurrence.

Discussion.

Given an annual incidence of only ~1.8 per million in the United States [8], PVNS of the ankle is appropriately considered an orphan disease. Ankle involvement accounts for roughly 7–9% of PVNS cases [2]. This rarity, combined with the often-indolent onset of symptoms, makes early clinical recognition challenging. Indeed, a multicentre review by Xie et al. noted an average ~18-month delay from symptom onset to diagnosis of PVNS [14]. In our patient, it took four years to arrive at the correct diagnosis. Initially, her complaints were attributed to benign causes (e.g. ankle sprain or growth pain), reflecting a common scenario where pediatric joint pain and swelling are presumed to be benign and self-limited. Only after symptoms persisted and progressed was advanced imaging obtained, revealing the true pathology. This case underscores the importance of considering rare diagnoses like PVNS in children with chronic monoarticular pain, especially when initial treatments for more common diagnoses fail. Furthermore, the lack of radiographic findings early in the disease (her initial X-rays were normal) likely contributed to the diagnostic delay, as PVNS-related bone erosions or calcifications typically appear only in later stages.

Clinically, diffuse PVNS of the ankle often presents with insidious ankle swelling, pain, and stiffness. Patients may or may not recall a precipitating injury. On exam, joint effusion or a boggy synovial mass may be palpable, and range of motion is often limited – consistent with our patient's presentation. Laboratory tests are usually non-specific; inflammatory markers can be normal or mildly elevated. Our patient's ESR was elevated (~30 mm/h), which is notable – a recent study found ESR elevation in 45.8% of PVNS cases, though typically only to a modest degree [1] (median ~13.5 mm/h in that series). Thus, while markedly high inflammatory markers are not the norm in PVNS, mild elevations of ESR/CRP can be present and should not exclude the diagnosis.

MRI is the imaging modality of choice. The pathognomonic MRI appearance of PVNS is due to hemosiderin deposition in the synovium: on T1-weighted images PVNS lesions often show low-to-intermediate signal, and on T2 or PD-fat sat sequences there is heterogeneous signal with blooming artifact from hemosiderin. Our case exhibited these classic features. Early in the disease, plain radiographs may appear normal, as in our patient. In more advanced cases, radiographs can show periarticular erosions with sclerotic margins, joint space narrowing, or soft tissue masses [12] – findings more often seen in weight-bearing joints like the hip, elbow, or ankle when PVNS has been long-standing.

The standard treatment for diffuse PVNS is complete synovectomy. Both arthroscopic and open techniques are employed. Open synovectomy generally allows more extensive clearance of diseased tissue (especially in hard-to-reach areas such as the ankle's posterior compartment or extra-articular tendon sheaths) and has been associated with lower recurrence rates in diffuse PVNS [19]. Arthroscopic synovectomy, on the other hand, offers quicker recovery and less stiffness, and is effective for localized disease or when lesions are accessible in a single compartment. According to the literature, recurrence rates after arthroscopic synovectomy for diffuse PVNS of large joints can range from about 40% up to 92%, whereas after open synovectomy they range roughly from 14% to 67%. (These wide ranges reflect varying follow-up durations and completeness of resection in different studies). In addition, the risk of osteoarthritis progression appears lower after thorough open synovectomy (0% in one series) compared to partial or arthroscopic approaches (reported 9–23%). In the ankle, complete excision is challenging due to the complex anatomy and confined joint space. A combined approach (arthroscopy for intra-articular lesions plus open surgery for extra-articular components) is sometimes recommended for extensive cases. In our patient, diffuse synovium extended throughout the ankle and into tendon sheaths, so we chose an open two-incision approach to maximally expose and resect all affected tissue. This "dual incision" open synovectomy allowed effective clearance of both anterior and posterior ankle compartments.

Even with optimal surgery, diffuse PVNS carries a substantial risk of local recurrence. Reported overall recurrence rates in the ankle without adjuvant therapy can be as high as ~30–50% [3]. Adjuvant therapies are therefore often considered, especially for diffuse disease. External beam radiotherapy has been used post-synovectomy in some cases and can reduce recurrence,

but concerns about radiation exposure and joint stiffness have limited its use. Chemical or radiosynovectomy is an alternative adjuvant aimed at selectively destroying residual synovium. RSO involves injecting a radioactive isotope (commonly ^90Y for large joints) into the joint space, where its β-radiation ablates remaining synovial cells with minimal systemic effect [3]. This technique has been used for decades in inflammatory arthritis and hemarthrosis, and has shown benefit in PVNS as well. Studies indicate that performing RSO after surgical synovectomy can significantly lower the recurrence rate of diffuse PVNS compared to surgery alone [5]. For example, without adjuvant RSO, diffuse PVNS recurrences may approach 40–50%, whereas combined surgery plus RSO has achieved recurrence rates on the order of ~0–20% in some reports [3]. (In other words, adjuvant RSO can roughly halve the recurrence risk, although results vary by study.) Our management aligns with this approach: we administered intra-articular ^90Y after surgery to eradicate residual disease and mitigate recurrence risk. It should be noted that while ^90Y is effective, its high radiation penetration can pose risks in smaller joints like the ankle [4]. Some authors recommend using a lower-energy isotope (such as Rhenium-186 or Erbium-169) for ankles to avoid complications like skin necrosis; indeed, cases of radionecrosis have been reported when high-dose ^90Y was used in ankle joints. In our case, we used a conservative ^90Y dose (~5 mCi) and encountered no adverse effects. The patient tolerated RSO well, and we observed no recurrence through one year of follow-up. Long-term vigilance is still required, as PVNS can recur even years later.

This case illustrates that diffuse PVNS of the ankle in a pediatric patient can be successfully managed with an aggressive combined-modality approach. Early recognition is crucial to prevent prolonged joint damage. For any child with chronic monoarticular joint swelling and normal radiographs, PVNS should be included in the differential diagnosis after ruling out infection or inflammatory arthritis. MRI should be employed early to identify synovial proliferative disorders. Once diagnosed, thorough synovectomy is paramount. Our preference is open excision for diffuse ankle PVNS to ensure complete resection. Adjuvant RSO, when available, is a valuable addition to reduce the likelihood of recurrence [5], provided it is used judiciously with appropriate isotope selection and dosing. The excellent functional recovery and absence of recurrence at 12 months in our young patient is encouraging, as PVNS in weight-bearing joints can often lead to significant morbidity. We plan to continue follow-up monitoring; if recurrence is detected, further intervention (repeat synovectomy and/or RSO) would be considered.

Conclusion.

Diffuse PVNS of the foot and ankle poses a complex clinical challenge, especially in pediatric patients where it can masquerade as benign conditions and lead to delayed diagnosis. This case underscores the importance of considering PVNS in the differential diagnosis of chronic ankle pain with swelling, even in children, and the utility of MRI in early detection. The preferred treatment is surgical synovectomy (open or combined open/arthroscopic for extensive disease) to achieve maximal resection. While arthroscopic excision minimizes surgical morbidity, open synovectomy often yields more complete removal and thus lower recurrence in diffuse PVNS. Adjuvant intra-articular RSO can be safely and effectively employed after surgery to further reduce recurrence risk. In our patient, this multimodal approach led to resolution of symptoms, restoration of ankle function, and no recurrence to date. Long-term follow-up is essential, but the outcome suggests that even in pediatric diffuse PVNS of the ankle – a rare and difficult condition – a combination of timely diagnosis, aggressive surgical synovectomy, and adjunctive RSO can achieve an excellent result.

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