



## Case report

# A rare case of Baker's cysts with hematoma of the lower calf treated with arthroscopic internal drainage combined with intramuscular dissection

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## ABSTRACT

Popliteal cysts, also termed Baker's cysts, are clinically common cystic lesions in the popliteal fossa. Typically, the contents of a ruptured cyst tend to spread into the myofascial interfaces in any direction, most commonly inferomedially or into a palpable superficial position. However, to our knowledge, reports of Baker's cysts dissecting into the deep intermuscular septum of the lower calf are extremely rare. We present here the details of the successful treatment through arthroscopy combined with lower calf incision of a patient who sustained hematoma of the knee and lower calf secondary to Baker's cyst rupture. Given the rarity of this disease in China, we present this case report to improve our understanding of the disease and avoid misdiagnosis and provide evidence for its clinical treatment, management, and prognosis.

## 1. Introduction

Popliteal cysts, also termed Baker's cysts, are clinically common cystic lesions in the popliteal fossa. It was first systematically described by Baker, a British surgeon in the nineteenth century [1]. According to Baker, popliteal cysts were formed by some normal bursa communicating with the knee joint or hernias of the synovial membrane when the synovial fluid produced in the knee leaked out from the weak areas [2]. Under certain circumstances, a Baker's cyst may rupture, giving rise to pronounced distension and discomfort in the knee or even the calf. Typically, the contents of a ruptured cyst tend to spread into the myofascial interfaces in any direction, most commonly inferomedially or into a palpable superficial position [3]. However, to our knowledge, reports of Baker's cysts dissecting into the myofascial compartments of the lower calf are extremely rare. Recently, we successfully treated a patient who sustained haemarthrosis of the knee and lower calf secondary to Baker's cyst rupture and subsequent dissection into the intermuscular septa, by using arthroscopy combined with lower calf incision. We believe this case report highlights the rarity of this disorder in China and the deceptive characteristics of its early manifestations in our patient.

### 1.1. Case/Case series presentation

A 52-year-old man presented with swelling and pain in his popliteal fossa. Physical examination revealed a swelling proximal to his knee from the level of the adductor hiatus to the lower calf. According to the patient's self-report, symptoms in his right knee joint had

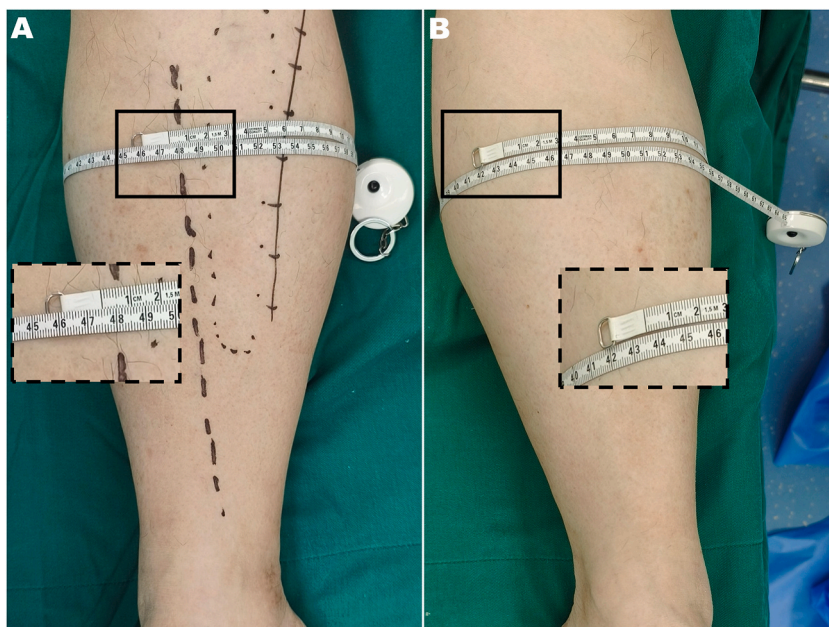
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already appeared 8 weeks before presenting to our hospital. Early manifestations were mild swelling of the knee joint that aggravated after flexion-extension movements, with soreness and swelling behind the joint in the popliteal fossa when extending the knee straight. The patient tried to relieve the persistent discomfort by repeated flexion and extension of the knee joint, with slight relief. About 6 weeks before admission to our hospital, during one knee flexion and extension movement, the patient felt transient sharp pain in the posterior aspect of the knee, and felt that the knee swelling had slightly reduced. However, on the second day after this movement, the patient developed symptoms of calf swelling. Therefore, the patient sought medical care at a local community-level medical institution for ‘calf swelling and soreness’ and underwent lower extremity vascular ultrasound which showed muscle vein thrombosis between the calf soleus muscles. In the early admission period, doctors at the local hospital did not inquire about his medical history in detail or conduct other examinations, rather started anticoagulant and pain-relieving therapy. However, during subsequent hospitalization, although the patient’s knee swelling and pain were mildly relieved, the swelling in his calf gradually worsened. Three days before admission, to clarify the reason for these unresolved symptoms, the local hospital repeated the lower extremity ultrasound. During this ultrasound examination, due to the patient’s significant calf pain, the scope of the examination was extended to include all areas in the lower where the patient reported pain. The results showed fluid-filled dark areas between the calf muscles, and the muscle vein thrombosis found on the first ultrasound seemed recanalized. At this point, the patient’s calf pain had considerably worsened. For better diagnosis and treatment, he was transferred to our hospital.

Upon physical examination in our hospital, the knee joint and lower calf of the patient was significantly swollen. A 12 cm × 4 cm cystic mass with obvious fluctuation could be palpated from the posterior side of the knee joint on the medial side of the calf. The range of motion of the knee joint was significantly limited because of pain and swelling in the knee (VAS pain score: 5 of 10). Furthermore, the right calf presented overall erythema and engorged superficial veins compared to the left. Even slight palpation of the swollen area on the medial calf provoked severe pain to the patient (VAS pain score: 8 of 10). Meanwhile, pulsation of the right dorsalis pedis artery was also weaker than the contralateral side, suggesting possible impact on blood supply to the distal lower extremity. Fortunately, there were no neurological symptoms (Fig. 1 A, B). This 52-year-old male patient is 173 cm tall, weighs 90 kg, with a BMI of 30. He works as a warehouse inspector, which requires him to frequently squat down to check goods. He has a history of smoking approximately 20 cigarettes per day. He occasionally drank alcohol in moderation, but has abstained from alcohol for about 8 weeks due to his current illness. At a local medical institution, he received irregular anticoagulation therapy with rivaroxaban 15 mg twice daily for about 4 weeks. The patient had no history of trauma, but had a 5-year history of poorly controlled hypertension with significant fluctuation. Blood pressure on admission was 170/100 mmHg. The patient’s blood parameters showed a normal white blood cell (WBC), while the C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were 53 mg/L and 38 mm, which were nearly 20-times and 2-times higher than the normal values, respectively. The coagulation parameters revealed D-dimer of 3.09 mg/L and fibrinogen of 5.84 g/L, which were also higher than the normal values.

The plain radiograph of the affected knee showed no abnormal findings (Fig. 2 A, B). The patient then underwent lower extremity venous and arterial ultrasound examination, which excluded thrombosis. However, ultrasound suggested the presence of a fluid-filled hypochoic zone extending from the posterior knee joint to the dorsal side of the calf. To further investigate the mass, magnetic resonance imaging (MRI) was carried out, which revealed edema surrounding the right knee joint and infrapatellar fat pad. Fluid



**Fig. 1.** Preoperative calf circumference measurements of the bilateral lower extremities, demonstrating a calf circumference of 47.5 cm on the affected side (A) compared to 44.5 cm on the unaffected side (B).

collection was noted within the joint space, suprapatellar bursa, and popliteal fossa cyst. The maximum measured diameter of the popliteal fossa cyst was 44 mm (Fig. 3A–D). The popliteal fossa cyst extended inferiorly into the right calf, passing through the gastrocnemius muscle into the interval between the fibularis longus and soleus muscles, forming an oval-shaped calf cyst with a long axis of approximately 129 mm and short axis of 60 mm. A low-intermediate signal intensity on T1-weighted images and an intermediate-high signal intensity on T2-weighted images were noted within portions of both the cysts in the knee and the lower calf, revealing the internal communication between the popliteal cyst and calf hematoma in coronal and sagittal views (Fig. 4A–H). Given the patient's symptoms of some early signs of compartment syndrome, such as calf pain and tenderness, pale skin, and weakened distal arterial pulsations, emergency surgery was arranged for to prevent further progression of severe complications such as compartment syndrome. As ultrasound and MRI examinations suggested that the popliteal cyst and calf cyst were likely homologous, we preferred arthroscopic treatment of the popliteal fossa cyst followed by open excision of the calf cyst located between the fibularis longus and soleus muscles through a calf incision to achieve as complete an excision of the cysts as possible and minimize recurrence risk.

Prior to the surgery, the surgical portals required for arthroscopic procedures and the incision site for the calf were pre-marked (Fig. 5A). The patient underwent surgery in a supine position. The operative procedure was conducted using three arthroscopic portals: the standard anterolateral, anteromedial, and the posteromedial portals. A standard 30° arthroscope was used for all the procedures. Using the posteromedial portal, the opening of the cyst was located by probing and manipulating the overlying capsular fold. Once the opening had been identified, the capsular fold was resected with basket forceps and an arthroscopic shaver. The valvular opening of the posterior capsule was enlarged for further resection of the capsular fold. The arthroscope was then switched to the posteromedial portal and advanced further to the posterior and distal aspect. Here, the cyst wall of the popliteal cyst could be fully visualized, and the surface of the wall was hypervascular and friable. The arthroscopic shaver was used to remove the cyst wall, with particular attention paid to protecting the adjacent neurovascular structures during this process. A biopsy sample was taken from the cystic wall. To minimize the chance of recurrence, a radical synovectomy was performed intra-articularly, especially at the suprapatellar pouch and medial/lateral gutter area. A suction drainage was inserted at the cyst resection site. The total operation time under arthroscopy was kept within 10 min, including approximately 5 min for infusing saline into the joint under arthroscopy to reduce the impact of arthroscopic surgery on the lower calf. The physical status of calf swelling was also monitored continuously during the procedure. After completion of the arthroscopic procedure, the arthroscopic surgical portals were sutured. Along the pre-marked incision site on the calf, a longitudinal skin incision of approximately 8 cm was made along the medial side of the left calf, which ran around the most prominent area where the cyst was palpable (Fig. 5B). The incision extended through the skin, subcutaneous tissues, and deep fascia. At the surface of the deep fascia, the region of the cyst in the calf could be felt with significant tension. The incision was made at the most fluctuant area on the surface of the deep fascia, revealing a significant amount of dark brown blood clots inside, suggestive of a hematoma within the mass (Fig. 5C). A suction device was used to thoroughly aspirate the fluid and clots from the cyst cavity, followed by irrigation of the cyst cavity using a pulse irrigator. Probing was performed towards the proximal and distal ends of the cyst cavity to ensure no residual cavities or septations. Communication between the mass and the knee joint was detected and repaired (Fig. 6 A, B). Gram's acid-fast, and fungal staining as well as bacterial culture of the haemorrhagic effusions were all negative. Thorough haemostasis was achieved using an electrome, and another drainage tube was placed. The incision was closed in layers with sutures, and compressive dressing was applied. The patient was prescribed medications to relieve swelling and pain in combination with preventive antibiotic therapy for 48 hours postoperatively (cefazolin sodium, 1g, 1 hour prior to surgery and every 8

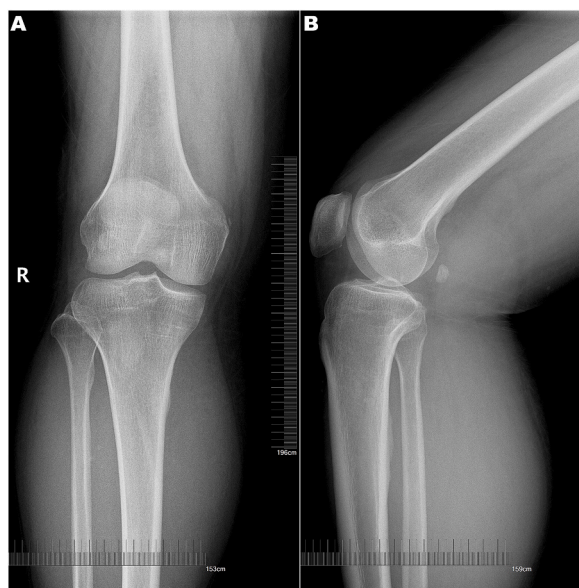
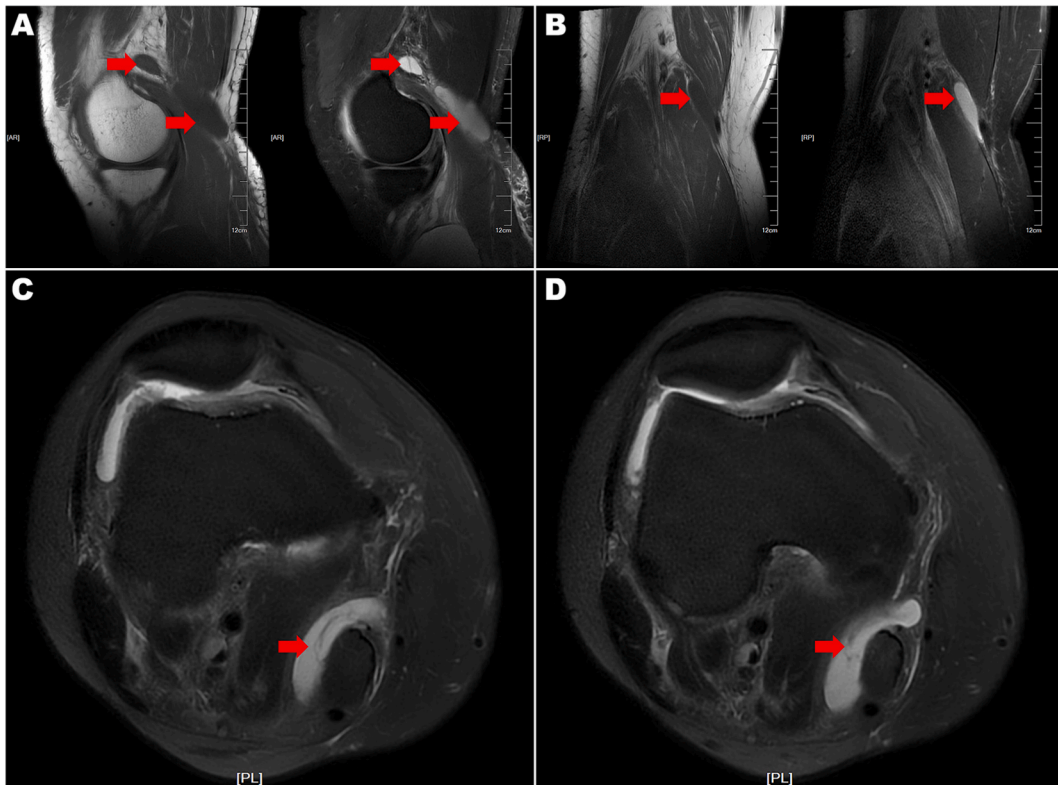


Fig. 2. X-ray (A, B) radiograph of the affected limb demonstrating no osseous abnormalities, but reflecting soft tissue swelling of the calf.



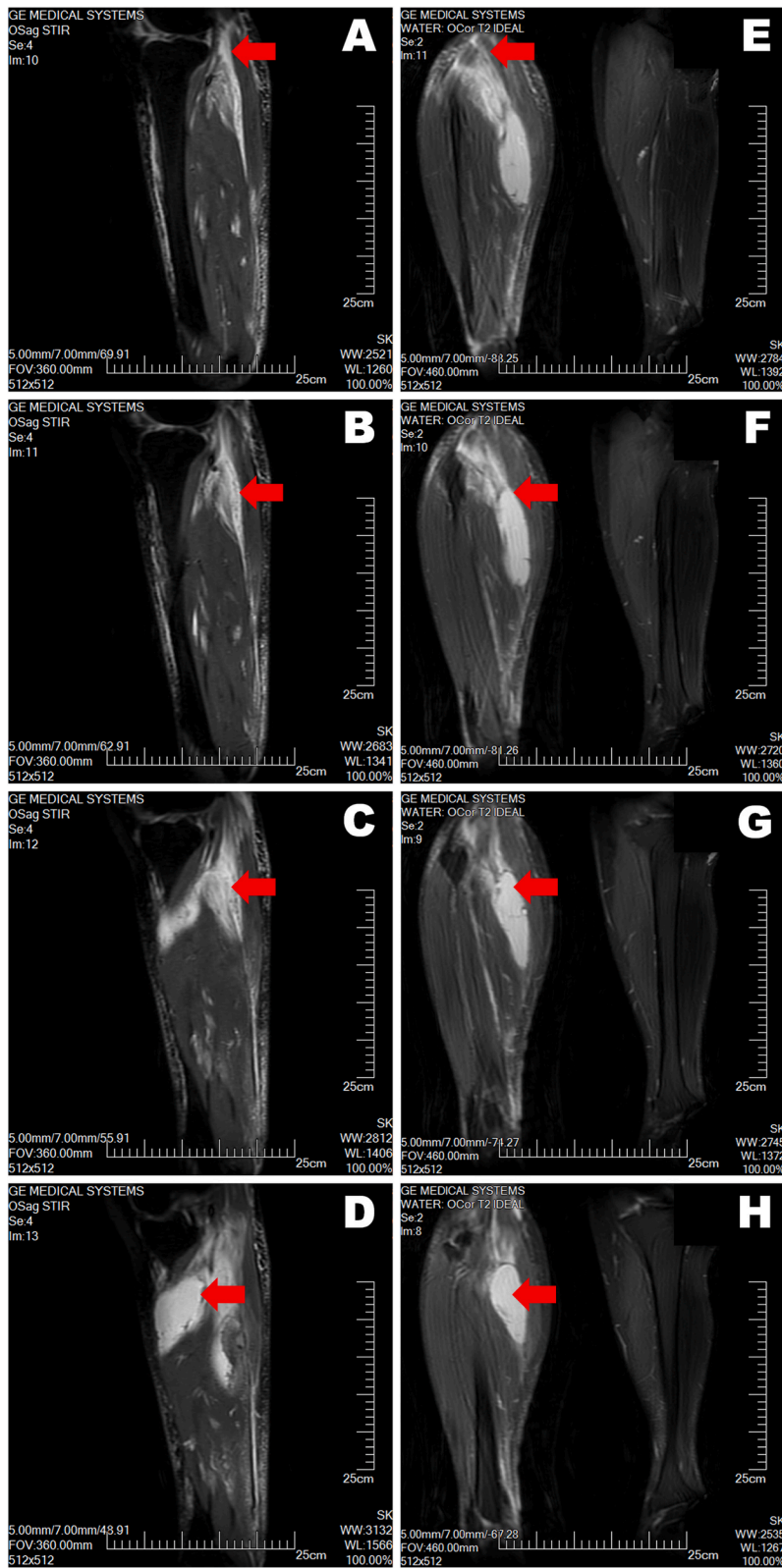
**Fig. 3.** Knee MRI (A–D) clearly delineating the location and size of the popliteal cyst.

hours postoperatively). The two drainages were removed on the third day after the surgery. The affected knee was kept in extension as often as possible after surgery and treated with cold compress therapy for the first 48 h. Off-bed activities were allowed the next day after the drainage tube was removed, and the patient was instructed to participate in quadriceps contraction and ankle pumping exercises. By day 7 after the surgery, the patient was allowed to engage in full weight-bearing walking. Histopathological examination also reported fibro-hyalinized tissues and plasma cells resulting from active chronic inflammation on day 7 (Fig. 7), which is consistent with histological descriptions of the cyst wall in other studies [4,5]. The pain and swelling were significantly relieved after the surgery (VAS pain score: 2 of 10 on day 2 and 1 of 10 on day 7 when discharge), and there were no relevant symptoms present at the time of the patient's discharge. A postoperative follow-up after 3 months showed no signs of cyst recurrence (Fig. 8A–D).

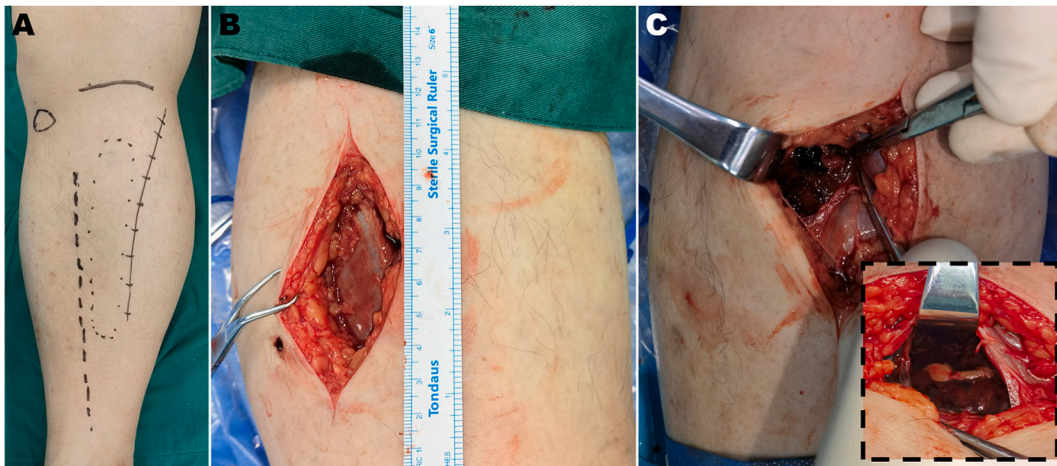
## 2. Discussion

Popliteal cysts in adult patients are mostly found in certain joint diseases such as rheumatoid arthritis, meniscus injury, osteoarthritis, and nonspecific synovitis [4,6]. The commonly accepted view is that the unidirectional valve mechanism is the pathogenesis of popliteal cysts. That is, when excessive effusion accumulates in the knee joint cavity because of certain knee-joint conditions, the increased intra-articular pressure forces synovial fluid to enter the gastrocnemius-semimembranosus bursa (GSB) through a transversal fissure-like structure which the fluid cannot reflux, leading to eventual formation and persistence of the cyst [7]. Rupture of the cysts may cause severe pain at the calf, with warmth, erythema, and tenderness. Moreover, these symptoms are easily misdiagnosed clinically as other lower limb diseases such as deep venous thrombosis or thrombophlebitis [8,9]. It is noteworthy that although popliteal cyst rupture is a common complication, lower extremity hematoma caused by this disease is very rare, with only a few published case reports so far [9–12], and no related cases have been seen in China yet. At present, there is no consistent conclusion regarding the causes of bleeding from the rupture. Considering that when the internal pressure increases, the effusion within the ruptured cyst tends to flow into the intermuscular space and expand it [10,11], sudden pressure fluctuation may abruptly accelerate this process and rupture the vessels distributed in the intermuscular space altogether, thus leading to hematoma formation. It has been reported that with the knee joint fully flexed, the fluid pressure within the joint cavity can rise up to as high as 1000 mmHg [12]; under such tremendous pressure fluctuation, it is difficult for the vessels within the intermuscular space to remain undamaged. If not treated correctly, rupture of a popliteal cyst accompanied by lower limb hematoma will further increase the pressure in the neurovascular bundle in and around the popliteal fossa, and may even progress to compartment syndrome [12,13]. If this occurs, the patient requires urgent surgical decompression to preclude permanent limb morbidity.

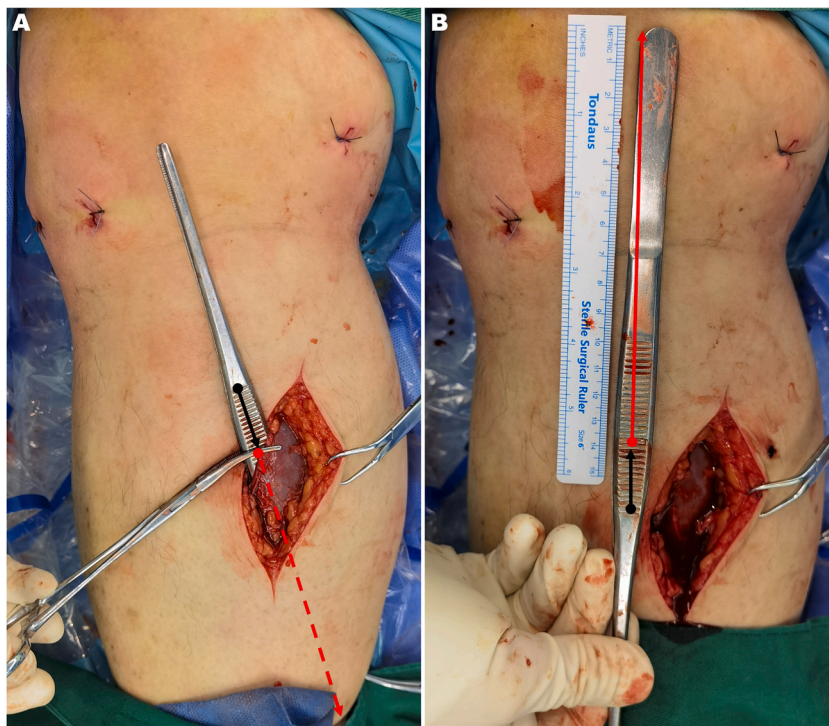
In this case, the patient had previously presented to a local hospital with posterior knee swelling, tightness, and a positive Foucher's



**Fig. 4.** Tibiofibular MRI demonstrating the location and extent of the inter-muscular cystic lesion within the calf, showing the internal communication between the popliteal cyst and calf hematoma in sagittal (A–D) and coronal (E–H) views.

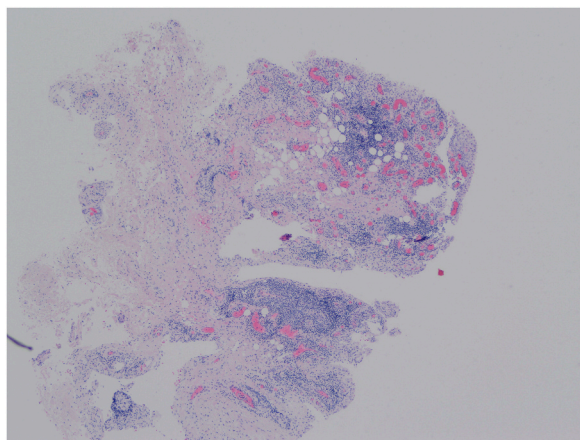


**Fig. 5.** A: Preoperative marking of the surgical site on the affected calf, planning for an incision of approximately 8 cm with the ability to extend proximally and distally by 2 cm as needed. B: Intraoperative incision measured approximately 8 cm. C: Upon deep fascial release, significant intermuscular pressure was noted with copious clot burden.

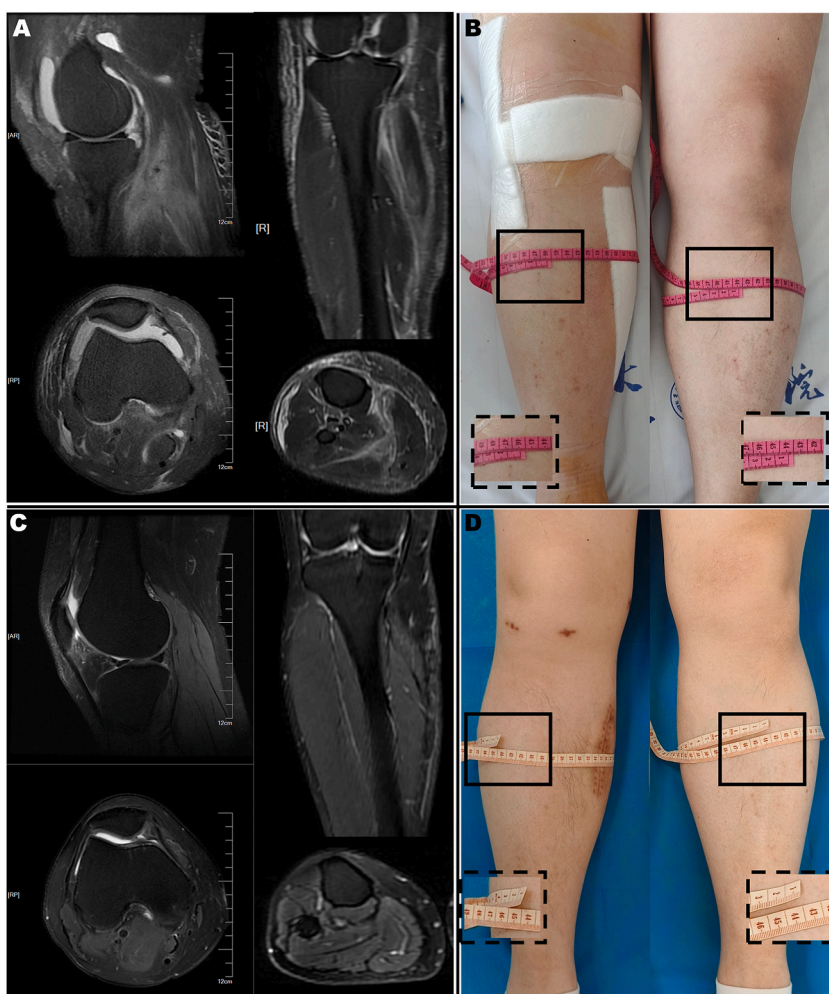


**Fig. 6.** Exploration of the distal extent of the fluid area using forceps, revealing the long axis to extend approximately 135mm distal to the incision, correlating with MRI measurements (129 mm).

sign attributable to a popliteal cyst. However, at this point, based to the patient's medical history, after a knee flexion and extension movement was performed to evaluate the symptoms, the knee joint swelling had mild remission accompanied by a transient sharp pain posterior to the knee joint. Yet, the chief complaint when the patient sought medical care at the local hospital was 'calf swelling and soreness'. Furthermore, the first ultrasound examination at the local hospital revealed calf muscle vein thrombosis. The misleading chief complaint and examination findings severely misled the diagnosis at the local hospital, ultimately resulting in no further examinations being carried out and the initiation of anticoagulant therapy. We can infer from this that the patient may have already experienced popliteal cyst rupture during knee joint movements before seeking medical care at the local hospital. Owing to the cyst rupture, the space it could 'hold' the effusion in was greatly expanded, which explains the reduced knee swelling that the patient



**Fig. 7.** Histopathological examination reported fibro-hyalinized tissues and plasma cells resulting from active chronic inflammation.



**Fig. 8.** Knee and tibiofibular MRI at postoperative day 5 (A) showing near-complete resolution of the fluid collection versus preoperative imaging, with some residual muscular edema. Calf circumference at postoperative day 5 (B) measured 46.5 cm on the affected side compared to 44.5 cm on the unaffected side. Follow-up MRI at 3 months (C) demonstrated complete resolution of the edema. Bilateral calf circumferences were similar (D).

experienced. At this point, part of the knee joint effusion entered the calf intermuscular space through the ruptured cyst. However, with the effusion constantly entering and bleeding from the rupture because of the unidirectional valve feature of the cyst itself, the limited capacity of the intermuscular space was soon exhausted, leading to progressively worsening calf swelling after a period of treatment at the local hospital, and further progression towards early signs of compartment syndrome [13]. During this process, the patient's greatly fluctuating blood pressure and the anticoagulant therapy received at the local hospital likely prolonged the bleeding time caused by cyst rupture and led to more intermuscular hematoma formation [14]. Unfortunately, given the lack of early diagnostic information, we can only infer this process based on the patient's self-report and the reports of two vascular ultrasounds performed at the local hospital.

This case highlights the high potential for misdiagnosis between deep venous thrombosis of the lower extremity and popliteal cysts. Lower extremity vascular ultrasonography, contrast-enhanced computed tomography (CT), and lower extremity MRI can all be utilized for the differential diagnosis of popliteal cysts. Among these, lower extremity vascular ultrasonography can definitively exclude deep venous thrombosis formation [15]. Serial bedside vascular ultrasonography can sometimes be performed to obtain more accurate results [16–18]. MRI can provide superior delineation of cyst morphology, extent, and relationship between the cysts and the ruptured hematoma. On MRI, Baker's cysts demonstrate low signal intensity on T1-weighted images and high signal intensity on T2-weighted images owing to the fluid contents of the cyst. While a ruptured Baker's cyst with calf hematoma shows low-to-intermediate signal intensity on T1-weighted images and intermediate-to-high signal intensity on T2-weighted images in the region of the hematoma [10]. The intermediate-high signal intensity on T2-weighted images often implies the presence of haemorrhage within the mass. Careful distinction should be made during the diagnostic workup. Incorrect early diagnosis and subsequent management may be ineffective or even detrimental.

As for the optimal management of ruptured popliteal cysts complicated by calf intermuscular hematomas, there is currently no definitive consensus. The treatment is dictated by the severity of symptoms and underlying causes. Surgical interventions such as open synovectomy/cystectomy, arthroscopic synovectomy/cystectomy, and biomechanical valve excision have been reported with overall successful outcomes [19]. Given its minimally invasive nature, arthroscopic surgery has been the preferred approach for popliteal cysts [20–22]. In this case, we opted for arthroscopic drainage of the popliteal cyst combined with open drainage of the calf hematoma. This dual approach was chosen for the following considerations: First, isolated drainage of the popliteal cyst without addressing the calf intermuscular cystic lesion may confer a higher recurrence risk, while concurrent resection can significantly reduce recurrence probability [23]. Second, due to the patient's marked lower extremity swelling and substantially elevated intercompartmental pressures conveying risk of compartment syndrome, isolated arthroscopic cyst drainage would be unlikely to provide adequate improvement in swelling. Additionally, communication between the popliteal and calf cysts carries the risk of iatrogenic worsening of lower extremity intercompartmental pressures and precipitation of compartment syndrome with isolated arthroscopic surgery [12, 13].

Despite the eventual satisfactory clinical outcome, this case report still has some limitations. First, the patient did not receive timely and correct diagnosis and treatment at the local hospital, leading to subsequent worsening of the condition. Second, this is still an isolated and rare case lacking generalizability, and more similar cases are needed to validate the findings. Finally, the efficacy of this treatment approach needs to be confirmed through longer-term patient follow-up. To address these issues, more in-depth research is required to elucidate the underlying mechanisms of cyst rupture and bleeding as well as corresponding early diagnostic approaches. Moreover, standardized clinical guidelines should incorporate consideration of such rare cases, necessitating large-scale multi-centre collaborative studies.

### 3. Conclusion

In this report, we presented a rare case of hematoma of the knee and lower calf secondary to Baker's cyst rupture and dissection into the deep muscle. The rarity of this case report lies in the high similarity between its early manifestations and those of deep venous thrombosis, which led to incorrect early treatment approach. To avoid such occurrences, the diagnosis and treatment of similar cases require a clear understanding of the patient's early symptoms, and comprehensive judgment based on imaging, ultrasound, and laboratory test results. Fortunately, through utilizing the combined approach of arthroscopic drainage and open calf fasciotomy, we could achieve a favourable outcome. We believe that this study may assist clinicians in improving our understanding of the disease, avoiding misdiagnosis and providing evidence for its clinical treatment and prognosis.

### Ethics statement

Written informed consent has been obtained from the patient to publish this paper, the patient has consented for all images and clinical data and other data included in the manuscript to be published. The patient provided informed consent to participate in the study. The patient provided informed consent for the publication of his anonymised case details and images.

### Data availability statement

No data associated with this study been deposited into a publicly available repository. Data will be made available on request.



## CRediT authorship contribution statement

**Wenbin Luo:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ao Wang:** Validation, Resources, Data curation. **Hairui Zhang:** Formal analysis, Data curation. **Zhiyao Zhao:** Formal analysis, Data curation. **Ye Zhang:** Resources, Investigation, Formal analysis, Data curation. **Xiaoning Liu:** Writing – review & editing, Resources, Project administration, Funding acquisition, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## References

- [1] M. Papadakis, A. Manios, C. Trompoukis, Popliteal cyst before William Baker: first report in the Galenic Corpus, *Acta Chir. Belg.* 117 (2) (2017) 131–134.
- [2] D. Fritschy, J. Fasel, J.C. Imbert, S. Bianchi, R. Verdonk, C.J. Wirth, The popliteal cyst, *Knee Surg. Sports Traumatol. Arthrosc.* 14 (7) (2006) 623–628.
- [3] C.S.J. Fang, C.L. McCarthy, E.G. McNally, Intramuscular dissection of Baker's cysts: report on three cases, *Skeletal Radiol.* 33 (2004) 367–371.
- [4] T.J. Frush, F.R. Noyes, Baker's cyst: diagnostic and surgical considerations, *Sport Health* 7 (4) (2015) 359–365.
- [5] P. Kongmalai, B. Chernchujit, Arthroscopic treatment of popliteal cyst: a direct posterior portal by inside-out technique for intracystic debridement, *Arthrosc. Tech* 4 (2) (2015) e143–e148.
- [6] J. Nakamura, T. Nagashima, Y. Akiyama, S. Minota, Ruptured Baker's cyst in rheumatoid arthritis, *Intern. Med.* 58 (3) (2019) 455.
- [7] P.G. Lindgren, Gastrocnemio-semimembranosus bursa and its relation to the knee joint. III. Pressure measurements in joint and bursa, *Acta Radiol. Diagn.* 19 (2) (1978) 377–388.
- [8] R.F. Kilcoyne, T.J. Imray, E.T. Stewart, Ruptured Baker's cyst simulating acute thrombophlebitis, *JAMA* 240 (14) (1978) 1517–1518.
- [9] M.H. Abdelrahman, S. Tubeishat, M. Hammoudeh, Proximal dissection and rupture of a popliteal cyst: a case report, *Case Rep Radiol* 2012 (2012) 292414.
- [10] M.J. Yoo, J.S. Yoo, H.S. Jang, C.H. Hwang, Baker's cyst filled with hematoma at the lower calf, *Knee Surg Relat Res* 26 (4) (2014) 253–256.
- [11] T.W. Kim, et al., Baker's cyst with intramuscular extension into vastus medialis muscle, *Knee Surg Relat Res* 24 (4) (2012) 249–253.
- [12] D.P. Petros, J.F. Hanley, P. Gilbreath, R.D. Toon, Posterior compartment syndrome following ruptured Baker's cyst, *Ann. Rheum. Dis.* 49 (11) (1990) 944–945.
- [13] J.E. Sanchez, N. Conkling, N. Labropoulos, Compression syndromes of the popliteal neurovascular bundle due to Baker cyst, *J. Vasc. Surg.* 54 (6) (2011) 1821–1829.
- [14] A. Jawaid, N. Amjad, K. Arif, Ruptured Baker's cyst in a 15-year boy, *J Coll Physicians Surg Pak* 28 (6) (2018) S135–S136.
- [15] K. Bansal, A. Gupta, Ruptured Baker's cyst: a diagnostic dilemma, *Cureus* 13 (10) (2021) e18501.
- [16] W.W. Zhang, J.K. Lukan, M.L. Dryjski, Nonoperative management of lower extremity claudication caused by a Baker's cyst: case report and review of the literature, *Vascular* 13 (4) (2005) 244–247.
- [17] G.C. Kandemirli, M. Basaran, S. Kandemirli, L.A. Inceoglu, Assessment of knee osteoarthritis by ultrasonography and its association with knee pain, *J. Back Musculoskelet. Rehabil.* 33 (4) (2020) 711–717.
- [18] M. Abate, L. Di Carlo, A. Di Iorio, V. Salini, Baker's cyst with knee osteoarthritis: clinical and therapeutic implications, *Med. Princ. Pract.* 30 (6) (2021) 585–591.
- [19] J.H. Yang, H.H. Kwon, J.K. Lee, S.Y. Bang, H.S. Lee, Successful arthroscopic treatment of refractory and complicated popliteal cyst associated with rheumatoid arthritis in combination with osteoarthritis: case series and literature review, *Rheumatol. Int.* 39 (12) (2019) 2177–2183.
- [20] H. Li, et al., Comparison of clinical outcomes associated with arthroscopic cyst wall preservation or resection in the treatment of popliteal cyst: a systematic review and meta-analysis, *Arch. Orthop. Trauma Surg.* 141 (10) (2021) 1741–1752.
- [21] X.N. Zhou, et al., Surgical treatment of popliteal cyst: a systematic review and meta-analysis, *J. Orthop. Surg. Res.* 11 (2016) 22.
- [22] J. Jiang, L. Ni, Arthroscopic internal drainage and cystectomy of popliteal cyst in knee osteoarthritis, *J. Orthop. Surg. Res.* 12 (1) (2017) 182.
- [23] J. Zhu, D. Xiang, S. Yang, L. Xiang, X. Liu, Arthroscopic internal drainage of popliteal cysts with cyst wall resection in pediatric patients, *Pakistan J. Med. Sci.* 38 (8) (2022) 2278–2283.