

# CALF PAIN AND SWELLING: BAKER'S CYST MIMICKING DEEP VEIN THROMBOSIS

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## ABSTRACT

*Venography is often requested to confirm the clinical suspicion of deep vein thrombosis (DVT) in patients with calf pain or swelling. Often, no clots could be demonstrated and the patients are discharged without a confirmed diagnosis. It is now being increasingly recognised that a Baker's (popliteal) cyst, ruptured or otherwise, may simulate deep vein thrombosis. Seven patients with a clinical suspicion of DVT were referred for venography but were found to have no thrombi within the deep veins of the calf. These patients were noted to have knee joint abnormalities. Baker's cysts were confirmed on subsequent knee arthrograms, ultrasonography or magnetic resonance imaging (MRI). It is emphasised here that a failure to demonstrate DVT in a patient with signs and symptoms of DVT should prompt a search for Baker's cyst. The pathological anatomy of Baker's cyst is briefly reviewed with the aid of magnetic resonance images.*

**Keywords:** popliteal cyst, osteoarthritis, rheumatoid arthritis, knee arthrogram, magnetic resonance imaging

SINGAPORE MED J 1996; Vol 37: 175-180

## INTRODUCTION

Venography is often requested to rule out deep vein thrombosis (DVT). In approximately 50% of these referrals thrombosis is documented<sup>(1-3)</sup>. It is, therefore, not uncommon to note no clots at venography in spite of well documented calf pain or calf swelling. These patients are often discharged without any confirmed diagnosis but with a guarded satisfaction that they do not have DVT. The actual incidence of Baker's cyst (popliteal cyst), ruptured or otherwise, simulating DVT is unknown but an increased awareness of this entity will lead to a higher detection rate. This is true today in spite of the increasing use of ultrasound in the diagnosis of DVT. The separation of the mentioned entities is important as their clinical management are different.

## PATIENTS AND METHODS

Seven patients with clinical suspicion of DVT were demonstrated to have normal calf veins during venography. All patients were noted to have joint abnormalities during fluoroscopy which prompted a search for popliteal cysts. Knee arthrography was performed shortly after venography on the day following consultation with the referring clinicians. In addition, magnetic resonance imaging and ultrasonography were done in one patient two weeks after a negative venogram. Single contrast arthrograms were carried out with the injection of 20-40 mL of contrast depending on the capacity of the knee joint, the presence of effusion or the size of the demonstrated Baker's cyst. It is important to do gentle exercises or delayed films of up to 20 minutes because a ruptured cyst may not be evident initially. This is probably related to adhesions at the neck of the cyst or at the site of the rupture. Lateral and frontal views were taken following gentle exercise. Arthrographically, an unruptured Baker's cyst has a rounded configuration and a smooth outline. Rupture is diagnosed when contrast spreads out along tissue planes and shows an irregular outline.

## RESULTS

Of the 7 patients with confirmed Baker's cyst, only one was

noted to have lateral deviation or compression of the popliteal vein. No significant findings could be seen in the remaining 6 patients. Ruptured cysts with dissection down the calf were noted in 3 patients. Cysts with no rupture were seen in the remaining 4 patients. The plain films of the knees were reviewed. Rheumatoid arthritis and osteoarthritis were confirmed in 3 and 4 patients respectively.

Fig 1a shows the frontal radiograph of a patient with typical findings of rheumatoid arthritis. Note the uniform joint space narrowing, osteopaenia and erosions with no demonstrable osteophytosis. The venogram performed revealed no signs of DVT (Fig 1b). Note the lateral deviation of the popliteal vein. A ruptured Baker's cyst with inferior extension into the calf was demonstrated (Fig 1c and 1d).

One patient with osteoarthritis (Fig 2a) and a normal venogram (Fig 2b) was further evaluated. Although the arthrogram showed a Baker's cyst with no extension inferiorly (Fig 2c), clinically a calf swelling was evident. This prompted an ultrasonographic examination (Figs 2d and 2e), and a subsequent magnetic resonance imaging scan (Figs 2f, 2g, 2h and 2i).

## DISCUSSION

Baker's cyst is due to distention of the gastrocnemius-semimembranosus bursa. The bursa itself is a normal anatomical structure located posterior to the medial femoral condyle between the tendons of the gastrocnemius and semimembranosus muscle (Fig 3). The anterior limit abuts the posterior surface of the joint capsule and is relatively thin. Communication between the bursa and knee joint is seen in 35%-55% of cadavers. The frequency of communication tends to increase with age. The communication is usually via a transverse slit, measuring approximately 15 mm - 20 mm and the opening is often covered with a fibrous membrane. This slit may have a ball valve effect allowing fluid to flow from the joint into the bursa. Slight distention of this bursa does not cause mechanical dysfunction. This lesion may, therefore, be asymptomatic and of no clinical significance.

The distended bursa may migrate medially away from the laterally located popliteal vein (Fig 3), laterally towards the popliteal vein (Fig 4) or superiorly along the medial aspect of the knee (Fig 5). In a study by Chaudhuri and Salari<sup>(4)</sup>, only patients with lateral deviation of the popliteal vein seen during venography were further evaluated with arthrography. Although not explained in their study, the hypothesis could be that Baker's cyst is a medially located lesion which may displace the popliteal

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**Fig 1a – Frontal radiograph showing diffuse knee joint space narrowing with evidence of small erosions. These are typical signs of rheumatoid arthritis.**



**Fig 1c – Frontal projection of a knee arthrogram showing a ruptured Baker's cyst with dissection down the calf. Note the cyst is located medially accounting for the lateral deviation of the popliteal vein.**



**Fig 1b – Frontal view of a venogram demonstrating no evidence of DVT. Note the lateral deviation of the popliteal vein (arrow).**



**Fig 1d – Lateral projection of the knee arthrogram showing the dissection with a serpiginous tract down into the calf.**



**Fig 2a – Frontal radiograph showing mild joint space narrowing with associated osteophytosis indicating osteoarthritis.**



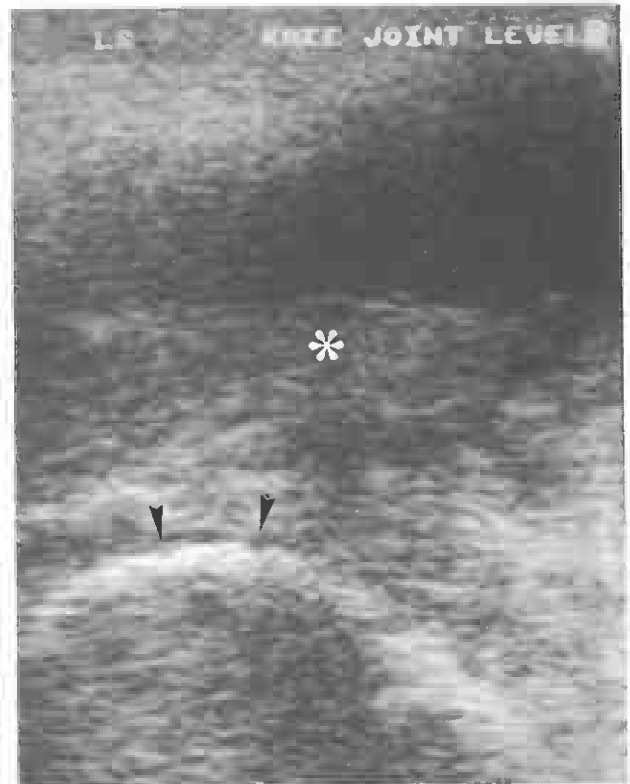
**Fig 2c – Lateral view of an arthrogram showing a Baker's cyst with irregular outline suggesting the presence of debris (arrows).**



**Fig 2b – Frontal view of venogram showing no evidence of DVT or deviation/compression of the popliteal vein.**



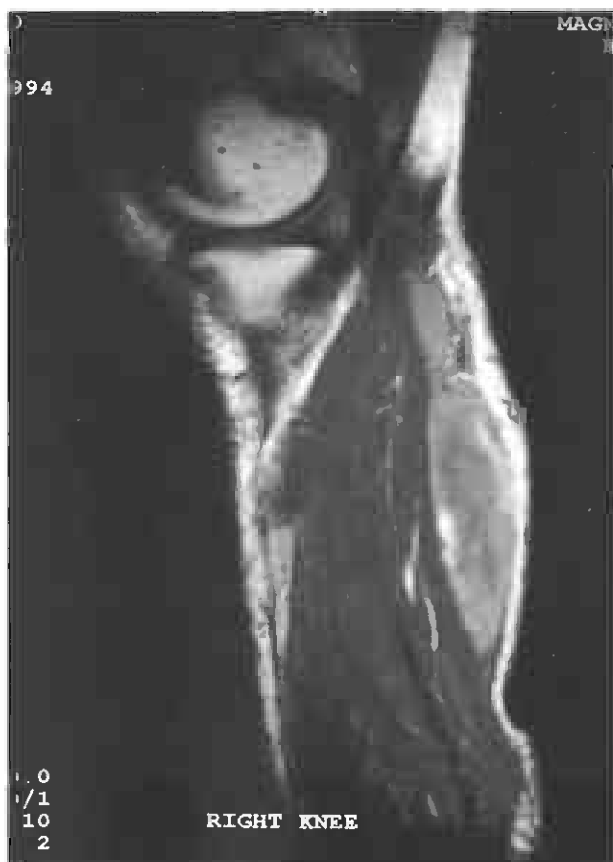
**Fig 2d – Ultrasonography at knee joint level illustrating the cystic nature of the lesion. Note the debris within the ruptured cyst (asterisk) and the posterior aspect of the tibial epiphysis (arrowheads).**



**Fig 2e – Ultrasonography at the mid-calf showing debris (asterisk) within the dissected Baker's cyst.**



**Fig 2f – Sagittal T1-weighted MRI showing loculated appearance of cyst dissection down the calf. Debris of intermediate signal intensity could be seen within cystic areas.**



**Fig 2g – Sagittal T2-weighted MRI showing better separation between high intensity fluid and intermediate signal intensity debris.**



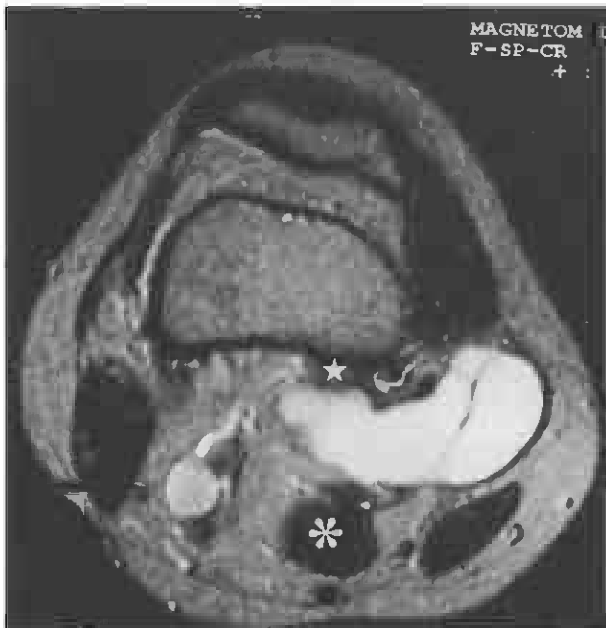
**Fig 2h – Axial T1-weighted MRI showing the dissected cyst location just beneath the subcutaneous tissues and the deep fascia. There is a layer of high signal intensity fluid posteriorly indicating the presence of blood.**



**Fig 2i – Axial T2-weighted MRI showing complex signal intensities reflecting the presence of fluid, debris and blood.**

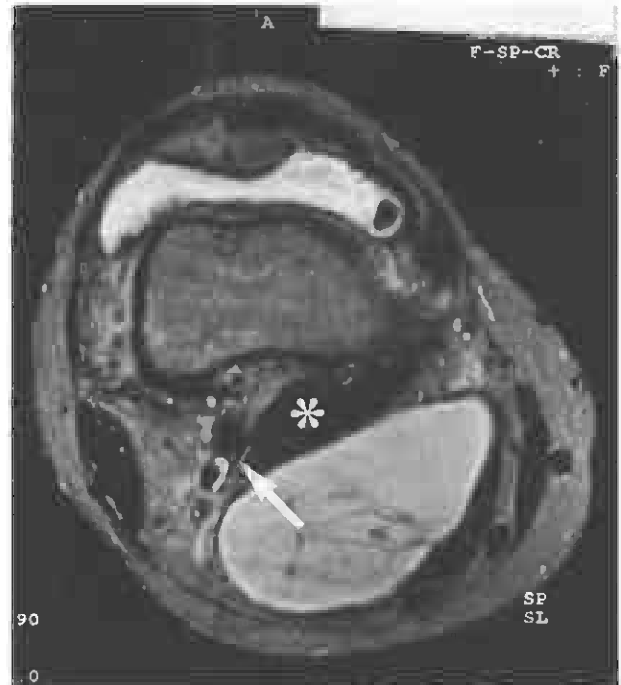


**Fig 3 – Axial T2-weighted MRI showing high signal intensity cyst emerging between the medial head of the gastrocnemius (star) and semimembranosus (asterisk) muscles. Note the position of the neurovascular bundle (arrow).**

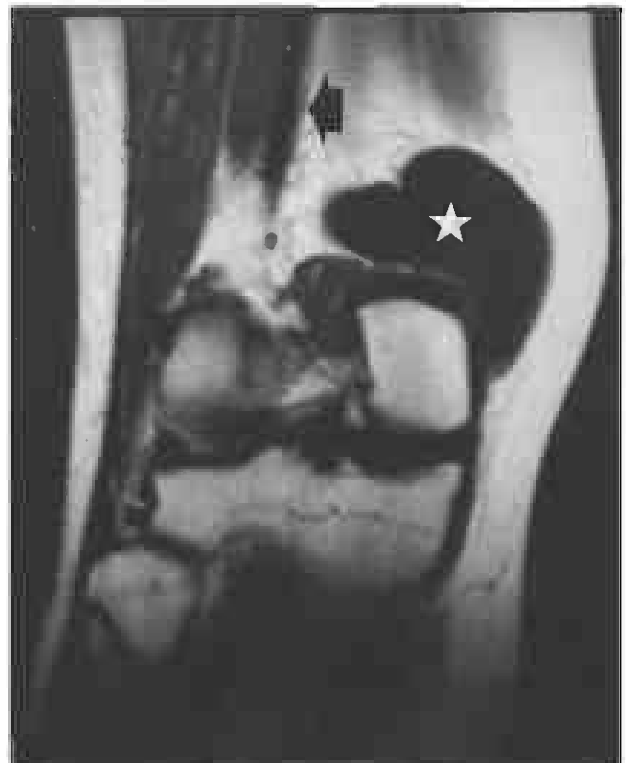


vein laterally. They found all 23 patients with the above venographic sign to have Baker's cyst. From the pathological anatomy illustrated, it can be appreciated that lateral deviation of the popliteal vein may be a very specific sign but probably lack sensitivity. Even large cysts may not come into contact with the popliteal vein. Only one patient in this small series showed deviation of the popliteal vein laterally. Chauderi and Salari used popliteal vein abnormality as the criterion for selecting patients for further study to confirm the presence of Baker's cyst. Patients in this study were selected for further investigation based on knee joint abnormality and clinical suspicion. The selection criteria of this study differ from that used by other authors. This explains the low incidence of popliteal vein abnormality in the

**Fig 4 – Axial T2-weighted MRI showing a large Baker's cyst with preferential medial tracking. The neurovascular bundle (arrow) shows slight lateral displacement as a result of the compression from the lateral head of the gastrocnemius muscle (asterisk).**



**Fig 5 – T1-weighted MRI showing a low signal intensity Baker's cyst with superior migration (star). Note the position of the neurovascular bundle above the knee joint (arrow).**



present study.

Baker's cyst is thought to be associated with underlying knee joint abnormalities. Wigley found cysts to be most commonly associated with rheumatoid arthritis<sup>(5)</sup>. He also stated that association with other conditions is rare although predisposing factors included trauma, gout, Reiter's syndrome, gonococcal arthritis and juvenile rheumatoid arthritis. Chaudhuri and Salari, however, encountered no cases of rheumatoid arthritis in their series<sup>(4)</sup>. Of the 23 patients reported in their study, 48% had varying degrees of osteoarthritis. Osteoarthritis and rheumatoid arthritis were represented in about equal proportions in this small series.

Before the advent of Doppler ultrasonography, venography the "gold standard", was routinely used to confirm or refute a clinical suspicion of DVT. The separation of patients with DVT from those with Baker's cyst is important. Patients with DVT require long-term anticoagulation therapy which necessitates close follow-up for effective treatment and prevention of complications. The symptoms of Baker's cyst on the other hand are treated with bed rest, support and non-steroidal anti-inflammatory drugs. The underlying cause may require treatment such as synovectomy in patients with rheumatoid arthritis and even knee replacement in some cases of osteoarthritis. Many patients, however, after the exclusion of DVT by venography or Doppler ultrasonography are discharged from hospital without a clear diagnosis. These patients should be investigated for the presence of a Baker's cyst. Up to 80% of patients with compression or deviation of the popliteal vein were subsequently noted to have Baker's cyst on arthrography<sup>(4)</sup>. Such a line of investigation calls for a high index of suspicion not only on the part of the clinician concerned but also the radiologist involved. The true incidence of Baker's cyst mimicking DVT is, not unexpectedly, still unknown in view of the number of diagnosis 'missed'. It is not unreasonable to assume the incidence of Baker's cyst masquerading as DVT to be higher than generally thought.

Ultrasonography is now gaining increasing importance in the diagnosis of DVT<sup>(6-8)</sup>. In some institutions or practices ultrasound has replaced venography as the modality of choice. Venography, the gold standard, is often reserved for cases not conclusively evaluated by ultrasound. Studies comparing the accuracy of ultrasound and venography in the evaluation of Baker's cyst have been reported in patients with rheumatoid arthritis<sup>(9)</sup> and following trauma<sup>(10)</sup>. Both these studies, however, did not address the problem of cyst rupture or dissection. This aspect was studied by Gompels and Darlington<sup>(11)</sup>. They concluded that ultrasound could not reliably demonstrate cyst

rupture when it is small, filled with debris or in the presence or gross calf oedema. However, in a total of 48 knees they could diagnose rupture with confidence in 2 patients and possible dissection in another 4 patients in view of the ill-defined and attenuated lower margins of the cyst. Ultrasound may be used to detect Baker's cyst if it is the initial modality chosen in excluding DVT. Arthrography should be carried out if the findings are inconclusive.

## CONCLUSION

Patients with calf pain, swelling and tenderness are usually assumed to have DVT until proven otherwise. This is a time-honoured rule of thumb and should remain so. This paper emphasises the possibility of a Baker's cyst masquerading as DVT. Hence, in the absence of venographic or sonographic evidence of DVT a physician should entertain this possibility. This is especially so in the presence of underlying joint abnormality.

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