ARTHROGRAPHY OF THE KNEE BEFORE AND AFTER SYNOVECTOMY
FOR RHEUMATOID ARTHRITIS

A. R. TAYLOR, AYLESBURY, ENGLAND
Oxford Regional Rheumatic Diseases Research Centre, Stoke Mandeville Hospital
and
B. M. ANSELL, TAPLOW, ENGLAND
Medical Research Council Research Unit, Canadian Red Cross Memorial Hospital, Taplow

Radiographic demonstration of the internal structures of the knee is not new, having been first described by Werndroff and Robinson (1905). It was not, however, until much later that more detailed papers on arthrography were published (Boyd 1934; Bircher and Oberholzer 1934; Simon, Hamilton and Farrington 1936; Quaintance 1938). Most papers describe its use in the diagnosis of ligamentous injuries. Lindblom (1948) described the findings in 4,000 examinations but there was only one for a synovial tumour and none for more generalised disease of the synovium.

This paper presents the typical findings of contrast arthrography in rheumatoid arthritis of the knee. This was performed in twenty patients with rheumatoid arthritis before and after synovectomy, the repeat examinations having been carried out between three months and one year after the operation. At the time of re-examination the clinical state of the joint was noted, with particular reference to pain, soft-tissue swelling, effusion and popliteal cysts. The clinical findings were then correlated with the radiographic pictures obtained by contrast arthrography.

TECHNIQUE OF ARTHROGRAPHY

After cleaning of the skin with spirit, local anaesthetic is injected into the skin and deep tissues on the lateral side of the knee. A number 1 needle is introduced into the lateral aspect of the knee deep to and opposite the middle of the patella, fluid being aspirated if a tense effusion is present. Twelve to eighteen millilitres of 65 per cent Hypaque are injected into the joint cavity. Vigorous knee movements are then carried out, including walking and squatting. After four minutes antero-posterior and lateral radiographs are taken.

The operative procedure for synovectomy of the knee was that of anterior clearance; in each case the synovium from the suprapatellar pouch was completely removed and the lateral and medial gutters cleared together with the intercondylar area. When a popliteal cyst was present this was removed through a separate incision.

RESULTS

Enlargement of the joint, seen particularly as an increase in size of the suprapatellar pouch, was a constant pre-operative feature. The normally smooth outline of the joint cavity was replaced by nodular smooth filling defects due to villous and nodular proliferation of the synovium (Figs. 1 and 2). In addition to the smooth filling defects there were less definite defects due to fibrinous loose bodies. These loose bodies could be seen in the generalised joint space, but were particularly evident when a popliteal cyst was present (Fig. 9). Communication with a popliteal cyst was a common finding, being present in about 40 per cent of cases (Taylor 1969). Other less frequent channels communicating with the posterior aspect of the
Case 1. Figure 1—Arthrograph showing marked enlargement of the suprapatellar pouch; projecting into it are multiple irregular filling defects representing nodular synovial proliferation. Figure 2—Film with the knee flexed shows multiple nodular filling defects both in the suprapatellar pouch and in the bulging posterior compartment of the knee. This latter enlargement should not be mistaken for a popliteal cyst. Figure 3—On extension of the knee the bulging posterior capsule has now become taut.
joint cavity were also seen and occasionally gave rise to some confusion, being interpreted as popliteal cysts or rupture. The communication with a popliteal cyst was constant in position, being situated on the medial side of the posterior joint capsule deep to the medial head of the gastrocnemius. On the lateral side of the posterior aspect of the joint other communications were sometimes present. In 10 per cent of patients a communication with the superior tibio-fibular joint was demonstrated. Extension of the contrast medium along the sheath of the popliteus tendon was another less frequent finding. These two infrequent findings may be mistaken for leakage of fluid from the joint cavity, as seen in rupture of the posterior capsule of the knee.

After satisfactory synovectomy the arthrographic picture tended towards normal, the joint cavity being smaller and smooth; but in the event of recurrence of the disease clinically the pre-operative and post-operative arthrographs could not be easily distinguished.

![Case 1 Arthrograph a year after synovectomy showing a smaller, smooth suprapatellar pouch.](https://example.com/image1)

**ILLUSTRATIVE CASES**

**Case 1**—A woman aged fifty-seven had had seropositive rheumatoid arthritis for ten years. Her main complaint was of constant pain, tenderness and swelling of the left knee which had been present for a year. Examination revealed a hot, tender knee with soft-tissue swelling. Contrast arthrography showed marked enlargement of the suprapatellar pouch; the outline of the cavity was irregular due to multiple filling defects which were particularly evident on each side of the suprapatellar pouch (Fig. 1). The lateral radiograph of the knee in flexion again showed the enlarged suprapatellar pouch with irregular filling defects. A posterior protrusion of the capsule was also noted. This bulge could have been mistaken for a popliteal cyst (Fig. 2), but when the capsule was taut in extension it disappeared (Fig. 3).

At operation anterior synovectomy was carried out. There was massive thickening of the synovium especially in the suprapatellar pouch, together with masses of fibrinous loose bodies.

A year after operation the patient was free from symptoms and on examination there was no local tenderness, synovial thickening or effusion. Movements were from 0 to 90 degrees. A second arthrography now showed the joint space including the suprapatellar pouch to be reformed, with the outline relatively smooth and the cavity considerably smaller (Figs. 4 and 5).
Figure 6—Arthrograph showing a large suprapatellar pouch with many nodular filling defects. Figure 7—Three months after synovectomy the arthrograph shows a small smoothly outlined suprapatellar pouch.

Case 3. Figure 8—Arthrograph showing typical irregular outline of the joint cavity with enlargement of the suprapatellar pouch. The poor filling of the popliteal cyst is due to its contained fibrinous deposits. Figure 9—Fourteen weeks after synovectomy and removal of the popliteal cyst. The arthrograph is indistinguishable from the pre-operative picture. The popliteal cyst has also reformed.
Case 2—A woman aged forty-six had had seropositive rheumatoid arthritis for six years, affecting particularly the right wrist and right knee. Severe pain in the right knee for several months had not responded to conservative treatment. On examination there was marked tenderness, pronounced synovial thickening and a large effusion. Arthrography showed an enlarged suprapatellar pouch of irregular outline (Fig. 6). At follow-up examination three months after routine synovectomy there had been complete relief of symptoms. Arthrography now showed a small smoothly outlined suprapatellar pouch (Fig. 7).

Case 3—A woman aged fifty had had seropositive rheumatoid arthritis twenty-five years previously affecting the upper limbs, feet and ankles. The right knee had been persistently painful for six months. Examination revealed moderate tenderness, effusion and marked synovial thickening. Arthrography showed much enlargement of the suprapatellar pouch; the outline of the cavity was irregular, with multiple filling defects (Fig. 8). The lateral radiograph (Fig. 8) showed an ill-defined popliteal cyst.

Anterior synovectomy with removal of the popliteal cyst was performed. There was profuse synovial thickening with massive collections of fibrinous deposits, both in the joint cavity and in the popliteal cyst, but more marked in the cyst. (This latter finding explains the poor definition of the cyst at arthrography.)

At follow-up examination three months after operation the patient was again complaining of swelling, tenderness and pain. Examination showed thickening of the synovium and moderate effusion, and the popliteal cyst had recurred. The findings at the second arthrography were almost identical with those seen before operation (Fig. 9).

A second synovectomy was carried out, at which the joint space was found to be completely reformed with a large suprapatellar pouch; there was also much thickening and papillary formation of the synovium, a synovial effusion and numerous fibrinous loose bodies. The popliteal cyst had reformed and was again found to be packed with fibrinous material. Three months later there had been substantial relief of symptoms without return of the synovial thickening or effusion.

DISCUSSION

In rheumatoid arthritis the synovial membrane shows characteristic changes in the form of proliferation of synovial cells, lymphocyte and plasma cell infiltration, congestion and abundant villous formation. In addition there is increased formation of synovial fluid and in some cases fibrinous deposits. The joint cavity may eventually become filled and distended with nodular proliferations of synovium, fibrinous deposits and synovial fluid, resulting in a generalised enlargement of the joint space. The suprapatellar pouch may become enormous; weakness and communications with bursae normally present are exploited, the most constant consequence of which is the formation of popliteal and calf cysts. These pathological processes can be correlated with the radiological findings at contrast arthrography (Taylor 1969).

The joint cavity was always enlarged before operation, and the normally smooth outline was interrupted by filling defects. Although characteristic of rheumatoid arthritis such defects are not diagnostic; similar appearances have been observed in pigmented villonodular synovitis (Rein, Bilodeau and Johanson 1964). At operation the degree of proliferation and thickening of the synovium together with the degree of fibrinous loose body formation correlated well with the state of the joint portrayed in the arthrographs.

It is known that in rats and rabbits after synovectomy the synovial lining is reformed by metaplasia of the underlying connective tissue (Key 1925, Wolcott 1927), the joint cavity appearing normal in about sixty days. In man also a new synovial lining is formed after synovectomy. In some patients with rheumatoid arthritis the regenerated synovium is reasonably normal, and there is lasting relief of pain and swelling. In others the newly formed synovium rapidly hypertrophies, with return of symptoms. The factors determining the course in individual patients are not yet known. Patients with a good clinical result after synovectomy showed arthrographically a reduced joint cavity, particularly in the suprapatellar pouch, and a smooth outline of the joint cavity. In those in whom the pathological process returned—sometimes as early as three months after operation—the arthrographic findings were indistinguishable from those before operation. This is illustrated by Case 3 (Figs. 8 and 9)
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in which a return of the synovial membrane to its previous state, together with the development of fibrinous loose bodies and a popliteal cyst, was confirmed at operation.

Contrast arthrography is a valuable aid in the diagnosis of calf swellings, particularly in the differential diagnosis of ruptured posterior capsule or popliteal cyst and deep-vein thrombosis. In cases of rupture, the contrast medium is seen to streak out into the soft tissues of the calf, whereas a popliteal cyst is shown as a smoothly outlined cavity. The distinction between rupture and deep-vein thrombosis is of practical importance in management (Harvey and Corcos 1960, Good 1964, Hall and Scott 1966, Hughes and Pridie 1970).

SUMMARY

1. In twenty-five patients with rheumatoid arthritis of the knee examined by contrast arthrography certain typical features were encountered. These consisted of enlargement of the suprapatellar pouch and loss of the normally smooth outline of the joint cavity because of nodular filling defects. In some cases less definite filling defects were seen, due to loose fibrinous deposits, particularly in popliteal cysts.

2. This method of assessment of the results of synovectomy of the knee correlated well with the clinical findings. The more satisfactory the clinical result the more normal the arthrogram. Patients who had recurrence of pain, swelling and tenderness in the knee showed arthrographic findings similar to those before operation.

REFERENCES


