

CIRCULATORY DISTURBANCES IN OSTEOARTHRITIS OF THE HIP

A Venographic Study

By

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Trueta & Harrison (1953) showed by post-mortem angiography that the normal femoral head has a very good intra-osseous circulation persisting into old age. Harrison *et al.* (1953) demonstrated an increased blood supply of the arthritic femoral heads and that the arterial vascular network always is intact. The same authors could illustrate the occurrence of a significant venous hyperaemia, mainly in the non-weightbearing parts of the head.

As a rule the size and number of the osseous veins exceed those of the osseous arteries (Rutishauser *et al.*, 1954; Tilling, 1958). The veins from the femoral neck and head have chiefly the same course as the corresponding arteries (Trueta *et al.*, 1953; Hulth, 1953, 1956). Rütt (1957) showed that the veins of the capsule and surrounding muscles in arthritic hips were intact and not thrombosized. The retinacular veins, however, which directly drain the blood from the femoral head and neck into the circumflex veins were apparently not included in Rütt's histological investigation. Rütt could prove that venous hyperaemia like stasis exists within the cancellous part of the head.

Venous circulatory disturbances in osteoarthritis of the hip have been clinically studied. Contrast medium, if injected intra-osseously, immediately leaves the bone *via* the veins situated nearest the place of injection. This is stated by several authors (for example Ducuing *et al.*, 1951; Ducci, 1950; Menegaux *et al.*, 1953; Hulth, 1953, 1956). The metaphyseal and epiphyseal areas of the long bones are normally very abundantly vascularized and the injected dye, therefore, fills several different veins. In Fig. 1, a cannula is inserted into the greater troch-

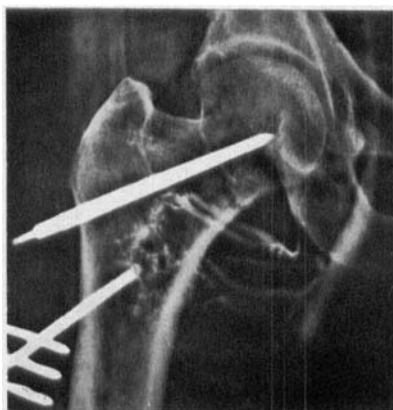


Fig. 1.

A normal venography of the trochanteric region. The medial and lateral femoral circumflex veins and the femoral-iliac vein are visible.

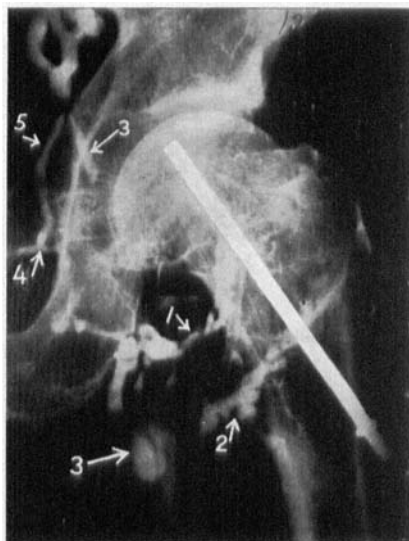


Fig. 2.

Postmortem venography of the femoral head. 1) Medial circumflex, 2) lateral circumflex vein, 3) femoral vein, 4) obturator vein, 5) internal iliac vein.

anter in an intracapsular fracture. Many veins running out from the site of injection can be seen. The most superior pair of veins is the medial femoral circumflex vein, which courses medially to the *crista intertrochanterica* on the dorsal side of the neck. Under it are the lateral femoral circumflex veins, coursing laterally to the *linea intertrochanterica* on the front side of the femur. Both these circumflex veins flow into the femoral vein visible in Fig. 1. There is a significantly small accumulation of dye at the site of injection and no contrast flows distally within the medullary canal. This picture illustrates the normal venous circulation of the hip. The venous vessel anatomy will also be clear from Fig. 2. The contrast injection was performed into the cancellous part of the femoral head of a cadaver. The pictures show the characteristics of the normal venous pattern of the upper femur, in accordance with investigations by Guilhem & Baux, 1954; Mériel *et al.*, 1955 and Harrison & Gossmann, 1955, among others. Principally this type of venography—the circumflex vein type—also occurs in cases of femoral neck fractures when the injection is performed into the femoral head (Hulth, 1953, 1956, 1958; Rehm & Süssse, 1955; and de Haas & MacNab, 1956).



Fig. 3.

Intra-osseous venography of a severe arthritic hip joint. There is a large accumulation of contrast. The only outflow of the contrast medium occurs *via* an intra-medullar vein in the femur shaft.

Mériel *et al.*, 1955, performed intra-osseous contrast injections in normal and osteoarthritic hips. They made the injection into the greater trochanter (not into the head) and found that normally the injection was easy and painless and without stagnation of the contrast medium. In arthritic hips, however, the injection was painful and the contrast was retained for a long time in the cancellous bone.

MATERIAL AND METHODS

Fifteen patients with unilateral or bilateral arthritic hips were investigated. A cannula provided with obturator and handle was used. The cannula tapers gradually to the tip, is ten centimetres long and has an inner diameter of about 2.3 mm (Hulth, 1956). In a few cases the cannula was inserted under general anaesthesia in connection with operation on the hip. In these cases a portable roentgen apparatus was used. In the remaining cases—examined under local anaesthesia—a film-changer was used. The cannula was inserted from the front percutaneously via a small incision. The femoral artery was palpated and the suitable direction of the cannula was indicated. Then the cannula was hammered into the head for about one centimetre. In eight patients both hips were examined simultaneously (with the aid of an assistant).



Fig. 4.

The same amount of contrast medium is injected simultaneously in both femoral heads. On the left side (moderate arthritis deformans) there is an almost normal venographic picture with circumflex veins and femoral vein contrast-filled. On the right side (severe arthritis deformans) the contrast flows mainly within the femoral medullar canal. Larger contrast accumulation of the right caput.

The injections started and ended at the same time and the same amount of dye (usually 6–8 cc) was used. The x-ray apparatus started at the very end of the injection.

RESULTS

In some of the most severe cases it was impossible to obtain contrast filling of any veins because the dye was leaking into the joint space. Probably this was due to the absence of any normal cancellous tissue. In addition, some of the arthritic cysts may have communication with the joint space (Rhaney & Lamb, 1955; Rütt, 1957).

A successful venography in severe osteoarthritis looks like Fig. 3. Here there is a large accumulation of dye within the bone and the only vein is the one running distalwards into the medullary canal. There are no extra-osseous veins visible which is remarkable considering the abundant venous network existing normally. The six cases where both hips were successfully examined simultaneously, yielded interesting pictures of the changes in the venous circulation in osteoarthritis. See Figs 4 and 5, which illustrate the condition in one-sided arthritis. Fig. 4 shows a rather severely diseased right hip and a slightly affected left.



Fig. 5.

Simultaneously injection of the same amount of contrast on both sides. On the left (normal hip) a very rapid outflow of contrast via circumflex vein. On the right (severe arthrit. deformans) contrast flows distalwards in the medullar canal.

The latter has well developed coronas of circumflex veins. In addition, the femoral and iliac veins are contrast-filled. In the right hip, however, there is but a slight circumflex venous pattern; instead, the distalwards intramedullary flowing of contrast medium is more obvious. Another case is illustrated in Fig. 5. Here the left hip is almost intact and the dye leaves the head very fast *via* the medial circumflex vein. On the right side the same amount of dye streams exclusively distalwards. The resistance at the injection was high on the right side and low on the left. In both these cases, as in the others, injection into the most diseased hip was very painful. Injection in the normal side, however, was almost painless. Fig. 6 shows a case of severe osteoarthritis, where the circumflex veins are visible, but most of the contrast accumulates or flows distally. Fig. 7 shows a case of an old healed necrosis of the femoral head after fracture. The same condition as in an arthritic hip seems to be prevalent. Contrast accumulates at the site of injection and a large intramedullar vein is visible.

Summarizing, the characteristics of contrast examination of hip osteoarthritis are:

- 1) The injection meets with a greater resistance than normally. The injection is more painful in the seriously affected hips.
- 2) The more severe the disease, the more intense and expansive the accumulation of dye at the site of the injection. The accumulation



Fig. 6.

A severe arthrit. def. The contrast flows partly out via circumflex veins but mainly via intramedullar veins distalwards.

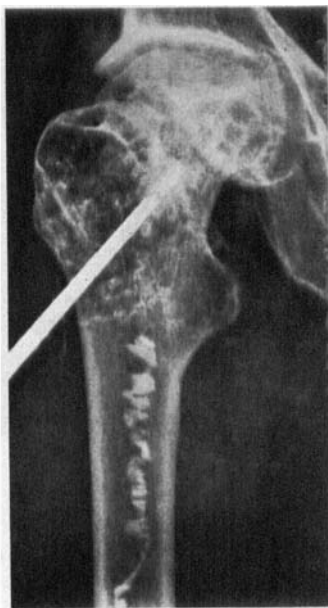


Fig. 7.

A healed necrosis of the head post fracture. The same venographic picture as in Fig. 3. Chiefly medullar veins contrast-filled.

is retained during more than 15 minutes while in the intact hip the dye disappears within a few minutes.

- 3) The venous pattern differs noticeably in the arthritic and the non-arthritic hips. In the former there are veins running distalwards into the femoral intramedullar canal; in the latter the typical coronas of medial and lateral circumflex veins occur.

DISCUSSION

In interpreting the above mentioned results it is obvious that the retention of injected dye substance is due to altered cancellous bone tissue of the arthritic joint, where the occurrence of cysts, necrotic trabecles and granulation tissue constitutes the characteristic feature. The contrast is simply retained in pathologically changed bone tissue. More noteworthy are the entirely changed venous pathways from the site of injection. The contrast medium in the diseased hips has to pass a much longer intra-osseous way before entering the large extra-osseous

veins, i.e. the femoral-iliac veins. In the normal hip, however, the contrast immediately leaves the bone and enters the femoral-iliac veins.

The pathological cancellous tissue in an arthritic femoral head creates conditions for intra-osseous venographies that are entirely different from those encountered in normal bone tissue. The contrast in the former may take "false" ways. It looks, however, on the roentgen pictures as if the injected contrast medium had spread out in the entire head and, therefore, had the possibility to run out *via* epiphyseal and metaphyseal veins if such veins had existed. It is thus very possible that these so-called retinacular veins have ceased to function in severe osteoarthritic hip. The venography might indicate a real venous stasis, which agrees with histological investigations by Harrison *et al.*, and Rütt.

The injection into an arthritic head is painful, but not into an unchanged head. This may be explained by the injection being performed into a cicatricial bone tissue under a resistance to injection. But even the venous stasis is increased at the injection and this may cause pain. The intra-osseous bloodvessels are according to—among other authors—Bazett and McGlone, 1928, abundantly supplied with nerve fibers and a dilation of these vessels may cause pain.

SUMMARY

Intra-osseous venographies of femoral heads in osteoarthritis were performed. Normally venographic pictures show circumflex veins. In osteoarthritis venography is characterized by accumulation of dye in the head, the evacuation of contrast from the head occurring mainly *via* medullar veins coursing distally into the femoral shaft. The injection in osteoarthritis is painful while in normal or little affected hips it is almost painless. The possibility of arthritic pains being partly caused by the impaired outflow of venous blood is discussed.

RESUME

Il a été effectué des vénographies intra-osseuses de têtes fémorales dans des cas d'ostéoartrite. Normalement les tableaux vénographiques montrent les veines circonflexes. Dans l'ostéoartrite, la vénographie se caractérise par l'accumulation du colorant dans la tête, l'évacuation du contraste ayant principalement lieu de la tête par les veines médullaires se dirigeant distalement vers le corps du fémur. Dans les cas

d'ostéoarthrite, l'injection est douloureuse, alors qu'elle est presque indolore dans les hanches normales ou très peu atteintes. La possibilité de douleurs arthritiques peut-être dues à un mauvais écoulement du sang veineux est discutée.

ZUSAMMENFASSUNG

Intraossöse Venographien von Femurköpfen in Fällen von Osteoarthritis wurden ausgeführt. Normalerweise zeigen die venographischen Bilder zirkumflexe Venen. Bei der Osteoarthritis ist eine Anhäufung von Farbe im Kopfe bezeichnend und die Entfernung des Kontrastes aus dem Kopfe geschieht grösstenteils auf dem Wege der modullären Venen, die distal in den Oberschenkelschaft einlaufen. Die Injektion ist schmerzvoll in Fällen von Osteoarthritis, während sie in normalen oder leicht erkrankten Hüften fast schmerzlos ist. Die Möglichkeit der Entstehung von arthritischen Schmerzen infolge des herabgesetzten venösen Blutabflusses wird besprochen.

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