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VENOUS DRAINAGE OF THE FEMORAL NECK IN LEGG PERTHES DISEASE AND IN HIP DYSPLASIA

A CLINICAL AND EXPERIMENTAL STUDY IN THE DOG
AND PIG

By

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ALITALO, I., E. HEIKKINEN, S. PAATSAMA, L. PUNTO, J. PURANEN and P. VIRKKUNEN: *Venous drainage of the femoral neck in Legg Perthes disease and in hip dysplasia*. Acta vet. scand. 1983, 24, 247—251. — Three clinical cases of canine avascular femoral head necrosis and 4 cases of hip dysplasia were examined using intraosseus femoral neck venography. The contrast medium passed into the diaphyseal bone marrow in all cases. Three growing dogs and 7 growing pigs were examined with the same method, before and after experimental ligation of the femoral veins. Before the venous tamponade, no contrast medium was visible in the femoral neck. The venography performed immediately after ligation showed contrast flow into the femoral neck similar to that seen in the clinical cases of Legg Perthes disease or hip dysplasia. However, a collateral circulation developed within 7 weeks. No more contrast-flow into the diaphysis was observed after that time.

Although osteomedullography shows that both in Perthes disease and in hip dysplasia venous drainage has failed, venous tamponade may not induce the onset of the disease.

hip dysplasia; Legg Perthes disease; osteomedullography.

Changes of venous drainage in human femoral neck diseases have been frequently reported. Venous engorgement and intraosseus hypertension in osteoarthritis of the hip as well as disturbed venous drainage of the femoral neck in Perthes disease have been described (*Phillips 1966, Arnoldi et al. 1972, Suramo et al. 1974*). *Heikkinen et al. (1975)* pointed out the abnormal

venous flow of the femoral neck in Perthes disease, and in the hip affected with synovitis; however, neither in coxa valga, in congenital luxation nor in congenital dysplasia was abnormal flow found. The prognostic value of osteomedullography in Perthes disease was also demonstrated by *Heikkinen et al.* (1979, 1980). An experimental study of haemodynamics of the femoral neck in the dog has been undertaken by *Lauder et al.* (1981). Legg Perthes disease and hip dysplasia are common in certain breeds of dogs but no clinical studies of canine femoral neck osteomedullography were available prior to the present study.

MATERIAL AND METHODS

The clinical material consisted of 7 dogs with femoral head disease. Three of those, 2 Fox Terriers and 1 Poodle, showed Legg Perthes disease in plain radiography. They were 5–8 months old. The disease resulting in severe lameness seemed to be insidious in onset having no obvious trauma in history. Abduction was markedly inhibited. Four dogs, aged 2–8 years, had dysplastic changes of the hip joints, such as luxation or distinct subluxation, obvious flattening of the margo acetabularis cranialis, deformation of the femoral head and/or osteoarthrotic signs resulting in stiffness and muscle atrophy. One of these dogs was a Labrador Retriever and three were German Shepherd dogs.

After usual clinical and radiological examinations of the dogs, intraosseus femoral neck venography was performed. The dogs were lying supine of the fluoroscopic table in "frog position" (dorsal recumbent position with hind limbs flexed and rotated outwards) under general halothane anesthesia. A sternal puncture needle with an external diameter of 1.5 mm was aseptically inserted into the medulla of the femoral neck. Three to 6 ml of meglumineamidotrizoate (Urografin 60 %®) was manually injected; duration 2–5 s. Immediately after the administration of the contrast medium, 3–5 radiographs were taken using an AOT cut film changer at intervals of 1 s.

The experimental material consisted of 3 small breed dogs (1 Beagle and 2 mongrels) aged 3–9 months and 7 growing Finnish landrace pigs. The age of the pigs varied from 2–5 months. The intraosseus femoral neck venographic technique was similar to that described above for the clinical material. In radiography, however, the 70 mm:s spot camera was used.

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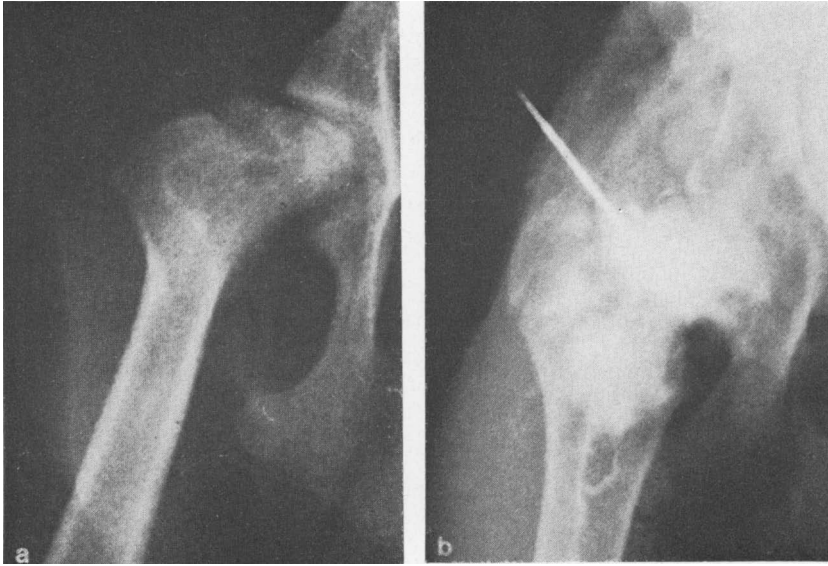


Figure 1. Radiographies of the right hip of a 8 months old Fox Terrier with Legg Perthes disease.

- a Plain radiography shows a loss of density and fragmentation with flattening of the femoral head.
- b The femoral neck osteomedullography reveals the contrast medium flowing into the diaphysis.

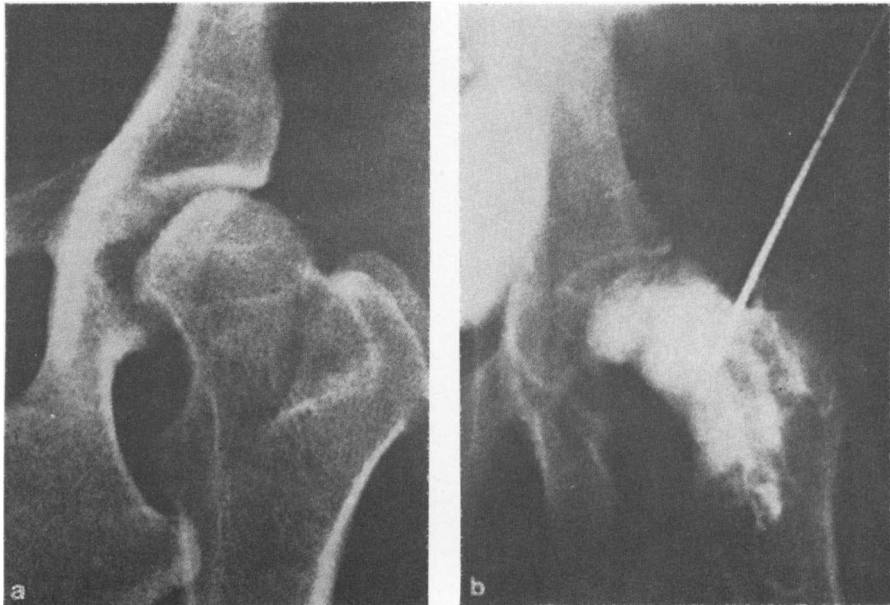


Figure 2. Radiographies of the dysplastic hip of a 2 year old Labrador Retriever.

- a Plain radiography shows dysplasia. Obvious incongruity between the deformed femoral head and the acetabulum with subluxation is seen.
- b The femoral neck osteomedullography reveals the contrast flow into the diaphysis.

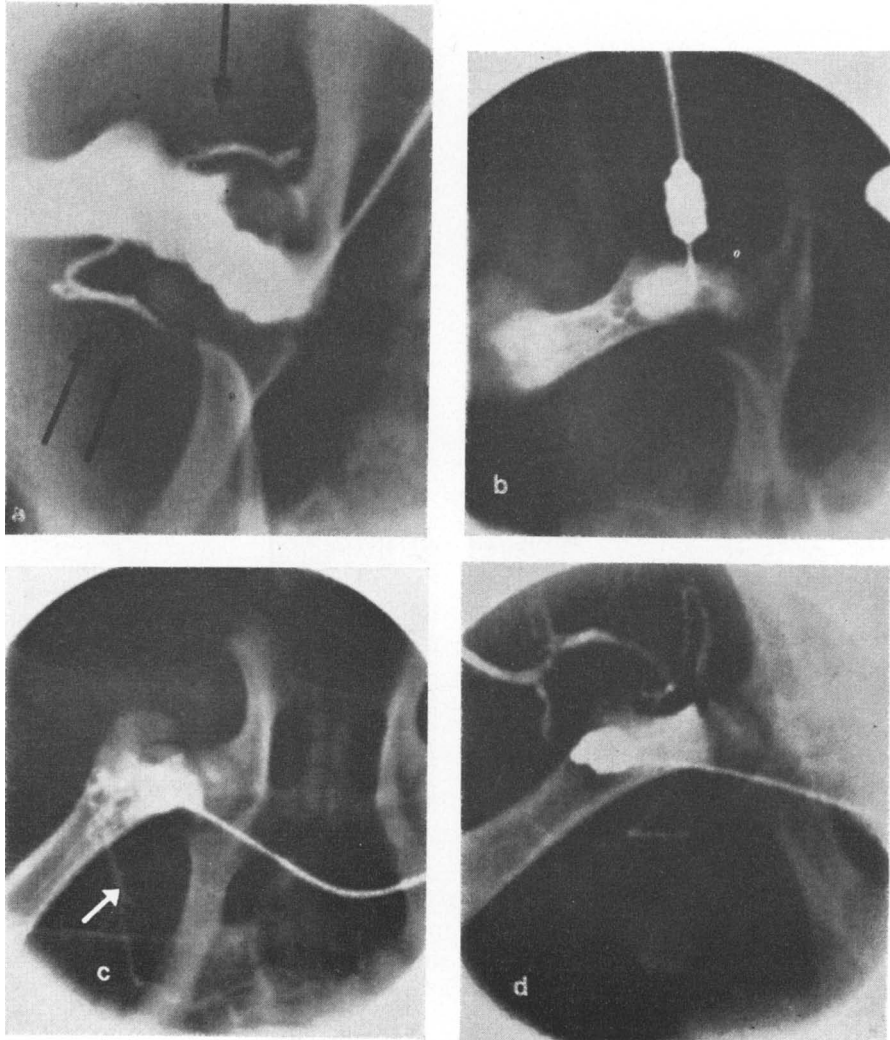


Figure 3. Osteomedullographies of the femoral head of a growing pig before and after the ligation of the gluteal and circumflexal veins.

- a Osteomedullography performed before the ligation reveals the contrast medium flowing through the gluteal (arrow) and circumflexal veins (2 arrows).
- b Immediately after the ligation, the contrast flows into the diaphysis.
- c Three weeks after the ligation, a part of the contrast flows into the diaphysis but some collateral veins are developed (arrow).
- d Seven weeks after the ligation, a complete collateral circulation appears. No contrast flow into the diaphysis is seen.

The femoral neck venous drainage was totally blocked after venography by ligating the gluteal, the medial as well as the lateral circumflexal veins. After the ligation the venography was repeated. The follow-up examinations were undertaken 1, 3 and 7 weeks postoperatively.

RESULTS

Clinical cases: In the 3 cases of canine Legg Perthes disease contrast medium injected into the femoral neck passed into the diaphyseal bone marrow (Fig. 1 a, b). In 3 cases of hip dysplasia contrast also passed into the diaphyseal bone marrow and no flow through gluteal and circumflexal was found (Fig. 2 a, b). In 1 case, a German Shepherd dog, most of the contrast passed into the diaphyseal bone marrow, some contrast flowing through the gluteal vein.

Experimental cases: In all animals, the contrast medium injected before the ligation flowed through the gluteal and circumflexal veins (Fig. 3 a). No contrast medium was fluoroscopically visible in the femoral neck after 1 min.

The venography performed immediately after the ligation showed contrast flow into the diaphysis (Fig. 3 b).

After 1 week the contrast medium still flowed into the femoral diaphysis. Three weeks after the ligation the main part of the contrast flowed into the diaphyseal but some collateral veins had developed (Fig. 3 c). The last venographies 7 weeks after the ligation revealed a complete collateral circulation and no contrast flow into the diaphysis (Fig. 3 d).

DISCUSSION

The anamnesis and physical examination in Legg Perthes disease usually yield information typical enough to submit the case for radiography and, thereby, definite diagnosis. Concerning the radiographic picture, the similarities between the dog and man are obvious (*Ljunggren 1967*).

The contrast media injected into the bone marrow of the healthy femoral neck flows through the gluteal and circumflexal veins into the femoral iliac veins (*Phillips 1966*). In the present study, 3 growing dogs with Legg Perthes disease were studied by injection of contrast into the femoral neck. The venous drainage in those animals proved to have failed and the contrast

passed into the diaphyseal bone marrow. The same finding in human Perthes disease has been previously reported (Suramo et al. 1974). Although the material of this study is small, the results indicate that disturbances in human and canine venous drainage in Perthes disease are not dissimilar. The femoral neck intraosseous venography was performed in 4 adult dogs with coxal dysplasia. Also in these cases contrast flowed into diaphysis of femur.

Lauder et al. have pointed out that venous tamponade results in decreased blood flow in growing dogs. In the immature individual, the tamponade may be involved in the development of Legg Perthes disease (Lauder et al. 1981). However, in the present experimental study in young pigs and dogs, neither Legg Perthes disease nor other avascular femoral neck disease was induced by blocking the femoral venous flow. Disturbed pattern of femoral venous drainage found in such diseases seems to be a manifold phenomena; the etiology still remains obscure. Several contributory factors have been proposed, eg. hormonal influence (Ljunggren 1967, Rokkanen et al. 1967) arterial supply disturbances (Nishio 1972), and genetic predisposition (Riser 1973).

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SAMMANFATTNING

Det venösa flödet i femurhalsen vid Legg-Perthes sjukdom och vid höftledsdysplasi.

En klinisk och experimentell undersökning hos hund och svin.

Tre kliniska fall av avaskulär caput femoris nekros hos hund och 4 fall av höftledsdysplasi undtrösktes genom intraosseal venografi i collum femoris. I alla fall trängde sig kontrastmedlet till den diafysära benmärgen. Experimentellt undersöktes 3 växande hundar och 7 växande svin med samma metod före och efter ligering av femorala vener. Före avstängningen av det venösa flödet kunde inget kontrastmedel ses i collum femoris. Vid venografi utförd genast efter ligering kunde ett likadant kontrastflöde till collum femoris konstateras som vid kliniska fall av Legg Perthes sjukdom eller höftledsdysplasi. Inom 7 veckor utvecklades dock kollateral cirkulation, varefter inget kontrastflöde till diafyssen kunde iakttagas.

Fastän osteomedullografi visar att det venösa flödet både i Legg Perthes sjukdom och höftledsdysplasi är insufficient kan enbart avstängning av det venösa flödet inte förorsaka sjukdomen.

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