Acta orthop. scand. *46*, 963–967, 1975

Departments of Orthopaedic Surgery and Clinical Physiology, University Hospital, Umeå, Sweden.

# PEROPERATIVE EFFECT OF FENESTRATION UPON INTRAOSSEOUS PRESSURE IN PATIENTS WITH OSTEOARTHRITIS OF THE HIP

J. ÅSTRÖM

Accepted 24.vi.75

The favourable effect of osteotomy upon pain at rest* in patients with osteoarthritis of the hip was thought by McMurray (1935) to be the result of alterations in mechanical factors while Nissen (1963) thought it to be due to a reduction of arterial hyperaemia. Venable & Stuck (1946) as well as Palazzi (1957–58) observed immediate relief of pain on resecting a fragment of cortical bone from the femoral neck. This relief of pain was explained as being the result of "decompression of bone".

Phillips (1966) demonstrated a delay in venous blood drainage with subsequent intraosseous blood congestion in coxarthrosis. Arnoldi et al. (1971) recorded an increased intraosseous pressure in the proximal femur in patients with coxarthrosis who experienced pain. An immediate decrease of intraosseous pressure was noted both during intertrochanteric osteotomy as well as during fenestration of the femoral head. Further, "normalization" of the venous blood drainage was demonstrated after osteotomy by Phillips et al. (1967).

These findings point towards a connection between pain, elevation of intraosseous pressure and impaired drainage conditions. Further, they suggest that the immediate relief from pain after osteotomy and fenestration may be due to a lowering of intraosseous pressure.

The aim of the present study was to investigate the peroperative effect upon intraosseous pressure in the femoral head and neck brought about by a fenestration procedure in the trochanter major in patients with osteoarthritis and pain.

---

* In the following the term pain means pain at rest.

## MATERIAL

The material included nine patients, seven women and two men, with degenerative osteoarthritis of the hip joint. Average age at the time of operation was 56 years (range 21–67 years). All patients suffered from pain.

Pain was defined as a dull ache, in the area of the affected joint, which frequently radiated along the inside of the thigh down to the knee. Its presence was independent of body posture and could not be relieved either by reduction of strain upon the affected joint or by a specific resting position of the limb. Pain was often aggravated by foregoing strain, but such aggravation frequently reached its maximum several hours after the triggering strain had ceased.

In all patients pain was a dominating symptom even though different degrees of osteoarthritis were represented in the material. None of the patients showed any signs of cardiac failure or arterial hypertension.

## GENERAL PROCEDURES

Each patient was informed about the aim of the operation and was also aware of the fact that this operation could not be guaranteed to produce long term pain relief.

### *Surgical technique*

The operation was performed under extradural anaesthesia. A lateral incision was made, exposing the greater trochanter and the proximal insertion of the lateral vastus muscle. The middle part of this muscle was detached and a pedicle of about 10 cm length was dissected free. The lateral aspect of the femur just distal to the greater trochanter was thus exposed and a $1 \times 2$ cm sized fragment of cortical bone was removed by means of a saw (Figure 1). The underlying cancellous bone was kept intact. The tip of the muscle pedicle was secured to the frames of the cortical window by four osteosutures. This fixation of the muscle pedicle was carried out in an attempt to prevent future healing of the window. The resection lines of the lateral vastus muscle were sutured lateral to the pedicle. Fascia lata and skin were sutured after placing a suction drain in the operation area.

### *Intraosseous pressure recordings*

Pressure registration was performed by means of the same technique and with the same equipment as described by Arnoldi et al. (1971). After preparation of the above-mentioned muscle pedicle two metal needles were inserted under two-plane X-ray supervision. One needle was placed with its tip as close to the centre of the femoral head as possible and the other needle with its tip in the centre of the femoral neck in line with the intertrochanteric crista. The needles were located in such a way that they would not interfere with the following fenestration procedure. Pressures in the femoral neck and head were recorded immediately before and immediately after removal of the "window" of cortical bone. Pressure readings were related to the level of the mid-axillary line which was assumed to represent the level of the heart with the patient in supine horizontal position. Venous pressures were not recorded since they were considered to be of minor interest in the context of this study.

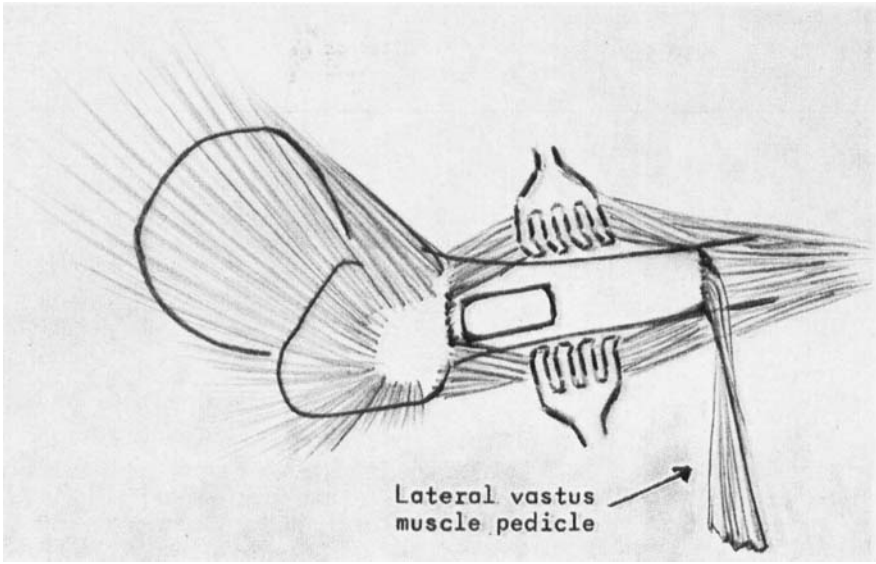


*Figure 1. Lateral aspect of the femur with the middle part of the lateral vastus muscle detached from the greater trochanter. Fenestration of cortical bone performed distal to the greater trochanter.*

## RESULTS

The individual intraosseous pressures before and after fenestration are shown in Table 1. It can be seen that in the femoral neck lower pressures were found after the fenestration procedure in all patients. In the femoral head the pressure was found to be lower in eight out of nine cases. In the ninth case the pressure remained unchanged after the fenestration procedure. The reduction of intraosseous pressure was more pronounced in the femoral neck than in the head.

## DISCUSSION

The patients in the present study represent different degrees of osteoarthritis but they had pain as a common symptom. Three patients had a clinical and radiographic picture not severe enough to justify major surgery. Six patients had severe osteoarthritis. The mean pressures in the femoral neck and head were found to be high compared to the pressure values found in radiographically normal hips by Arnoldi et al. (1972). These "normal values" were derived from the contralateral hip from patients undergoing operation for severe osteoarthritis in one

*Table 1. Intraosseous pressures in relation to heart level recorded before and after fenestration in nine patients suffering from osteoarthritis of the hip with pain at rest as a dominating symptom.*

| Patient | | Intraosseous pressure before fenestration | | Change (in mmHg) of intraosseous pressure after fenestration | |
|---|---|---|---|---|---|
| Sex | Age | P = caput | P = collum | Caput | Collum |
| F | 49 | 37.4 | 34.4 | — 2.9 | — 6.2 |
| M | 66 | 26.7 | 24.0 | — 3.0 | — 2.7 |
| F | 66 | 55.6 | 42.5 | — 4.2 | —15.7 |
| F | 63 | 48.7 | 20.6 | —14.2 | — 4.3 |
| F | 21 | 30.0 | 26.6 | — 9.9 | — 8.5 |
| F | 56 | 99.7 | 96.4 | — 8.2 | —24.7 |
| F | 67 | 45.0 | 36.2 | ± 0.0 | — 9.6 |
| M | 53 | 41.5 | 27.9 | — 1.3 | —12.6 |
| F | 64 | 52.1 | 34.9 | — 9.0 | —12.7 |
| | $\bar{m}$ | 48.5 | 38.2 | — 5.9* | —10.8* |

P = intraosseous pressure in mmHg.
$\bar{m}$ = mean pressure; mean reduction.
F = female.
M = male.
* = reduction significant at the 1 per cent level of probability according to sign test.

hip. In this study pain was only observed in patients with intraosseous pressure in the femoral neck of above 40 mmHg. In the present study pressure values above 40 mmHg in the femoral head were present in six out of nine patients preoperatively.

The fenestration operation is a minor surgical procedure which gives an immediate reduction of intraosseous pressure in the femoral head and neck in the majority of treated patients. This simple operation may be justified if the follow-up study now being carried out shows a reduction of pain over a reasonable period of time.

## SUMMARY

In nine patients with osteoarthritis of the hip who suffered from pain at rest, intraosseous pressure was measured in both the femoral head and neck before and immediately after fenestration in the lateral aspect of the greater trochanter. A small but significant drop in intraosseous pressure in both the femoral neck and head was registered as a result of the fenestration procedure.

## REFERENCES

Arnoldi, C. C., Lemperg, R. K. & Linderholm, H. (1971) Immediate effect of osteotomy on the intramedullary pressure of the femoral head and neck in patients with degenerative osteoarthritis. *Acta orthop. scand.* **42**, 357.

Arnoldi, C. C., Linderholm, H. & Müssbichler, H. (1972) Venous engorgement and intraosseous hypertension in osteoarthritis of the hip. *J. Bone Jt Surg.* **54**-B, 409.

McMurray, T. P. (1935) Osteo-arthritis of the hip joint. *Brit. J. Surg.* **22**, 716.

Nissen, K. J. (1963) The arrest of early primary osteo-arthritis of the hip by osteotomy. *Proc. roy. Soc. Med.* **56**, 1051.

Palazzi, A. S. (1957–58) On the operative treatment of arthritis deformans of the hip joint. *Acta orthop. scand.* **27**, 291.

Phillips, R. S. (1966) Phlebography in osteoarthritis of the hip. *J. Bone Jt Surg.* **48**-B, 280.

Phillips, R. S., Bulmer, J. H., Hoyle, G. & Davies, W. (1967) Venous drainage in osteoarthritis of the hip. A study after osteotomy. *J. Bone Jt Surg.* **49**-B, 301.

Venable, C. S. & Stuck, W. G. (1946) Muscle flap transplant for the relief of painful monoarticular arthritis (asceptic necrosis) of the hip. *Ann. Surg.* **123**, 641.

*Key words:* coxarthrosis; fenestration; interosseous pressure, peroperative effect upon

Correspondence to:

Jan Åström
Department of Orthopaedic Surgery
University Hospital
Umeå, Sweden