Intramedullary Pressure of the Patella in Chondromalacia

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Summary. Degenerative changes in load-bearing joints are often combined with altered intramedullary circulation. This may cause an alteration in intramedullary pressures. It has been said that articular symptoms are connected with a change in intramedullary pressures being high they are suspected to cause pain.

In this investigation the intramedullary pressure has been evaluated in chondromalacia and osteoarthrosis of the patella. A comparison has been made with normal patellae.

A biopsy needle was drilled into the intramedullary bone of the patella and connected with a registering unit.

In a control group an average value of 19 mm Hg was registered. In the chondromalacia group the mean intramedullary pressure was 44 mm Hg and in osteoarthrosis 37 mm Hg.

Changes of the vascular pattern and a rise of the intramedullary pressure have been observed in load-bearing joints with degenerative changes (Arnoldi et al. 1972; Goldie and Wetterqvist 1974). As early as 1909, Wollenburg suggested the possible role of ischemia in sub- and juxtacondral bone in osteoarthrosis. Many years later, and in contrast to Wollenburg's observation, Harrison et al. (1953) found a hyperplasia of the intramedullary arteries in the femoral head in osteoarthrosis. The arterial inflow was assumed to have increased. Venous stasis in the bone marrow was also observed.

In 186 patients with osteoarthrosis of the knee Brookes and Helal (1968) found at intramedullary phlebography an accumulation of the contrast medium located to the subchondral bone. The contrast medium cleared more slowly from the involved side, suggesting a sluggish circulation in the cancellous bone. Numerous subchondral medullary sinusoids were distended. In 14 patients examined after tibiofibular osteotomy for osteoarthrosis relief of pain concurred with a return to normal size of the distended subchondral vessels.

In osteoarthritis of the knee, Lynch (1974) found the intramedullary pressure of the proximal part of the tibia significantly higher (45.4 mm Hg; range 24–59 mm Hg) than in normal knees (29.1 mm Hg; range 17–34 mm Hg). Numerous elongated and dilated sinusoids were seen in the juxta-articular bone.

In 1974, Goldie and Wetterqvist reported on increased tibial intramedullary pressure in osteoarthrosis of the knee joint. One year after osteotomy a slight reduction was registered.

Arnoldi et al. (1975) reported a significant rise of the intramedullary pressure in knee joints with pain but without any signs of osteoarthrosis. The pressure was 28.4 mm Hg in the distal part of the femur and 31.9 mm Hg in the proximal tibia. In a control group of normal volunteers the pressures were 8.6 mm Hg and 9.8 mm Hg, respectively. In patients with pain and with osteoarthrosis the intramedullary pressure was raised in the distal part of the femur to 24.7 mm Hg but not significantly in the proximal part of the tibia where it was 12.5 mm Hg. The painful condition without osteoarthrosis later became known as the “intraosseous engorgement-pain syndrome” (Lempert and Arnoldi 1978).

The intramedullary pressure of the normal patella has been estimated at 10–15 mm Hg by Ficat and Hungerford (1977). In patients with a condition known as “reflex sympathetic dystrophy” of the knee joint the intramedullary pressure of the patella increased to 30–50 mm Hg (Ficat and Hungerford 1977).
The aim of the present study was to investigate the intramedullary pressure of the patella in patients with varying grades of chondromalacia and osteoarthrosis compared with a control group with conditions as near normal as possible.

**Definition**

Chondromalacia of the patella is a term commonly used to describe retropatellar discomfort or pain supposed to be due to varying degrees of degenerative change of the patella. Pain is usually evoked by activities which load the patellofemoral joint. Rest pain may be a part of the syndrome.

The degenerative changes of cartilage have been graded according to Collins (1949).

Chondromalacia grade 1: Part of the cartilage was slightly swollen and soft. Occasionally the colour had turned slightly yellow.

Chondromalacia grade 2: In part of the cartilage there were numerous fissures and some fragmentation of cartilage.

Chondromalacia grade 3: In part of the cartilage there were numerous fissures reaching to the bone and fragmentation of cartilage.

**Osteoarthrosis**

The degenerative changes of the patella cartilage in osteoarthrosis had the same morphologic features as in chondromalacia grade 3. In this material patients with an age above 40 years and exhibiting the said features were regarded to have osteoarthrosis.

**Material**

**Chondromalacia Patellae**

Intramedullary pressures of the patella were measured in 13 patients scheduled for surgical treatment because of chondromalacia. The indication for surgery was the sick history and clinical appearance of the patient. Symptoms should have persisted or become worse during a period of 4 months or longer. Clinical signs should remain the same at two or more examinations.

The mean age of the patients was 27 years (range 18–38 years). There were five women and eight men (Table 1).

All patients had followed a course of conservative treatment which was the following:

1. Attempts at avoiding dynamic and static loads provoking patellofemoral pain.
2. Isometric training of the quadriceps muscle.
3. Administration of an antiphlogistic drug for 2–4 weeks.

At arthrotomy the following observations were made: Three patients had grade 1, seven grade 2, and three chondromalacia grade 3 (Table 2).

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Chondromalacia</th>
<th>Osteoarthritis</th>
<th>Control</th>
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<tbody>
<tr>
<td></td>
<td>Women</td>
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</tr>
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<td>10–19</td>
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<td>4</td>
<td>3</td>
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<tr>
<td>30–39</td>
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<td>40–49</td>
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<td>50–59</td>
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<td>1</td>
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<tr>
<td>Total</td>
<td>5</td>
<td>8</td>
<td>1</td>
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In six patients a medial meniscal tear was also present. Three of them were found in patients with chondromalacia grade 1 and three in patients with chondromalacia grade 2.

**Osteoarthrosis**

The indication for surgery was the same in this group as for chondromalacia patellae. There were two men and one woman.

**Control Group**

Thirteen patients without signs of patellar engagement, but who were going to be operated on for meniscal tears, were selected as a control group. For ethical reasons, it was not possible to obtain a normal material. Therefore, patients with a meniscal tear were selected as a control group. Age and sex are presented in Table 1. At arthrotomy chondromalacia of the patella of grade 1 was found in three joints. These patients had preoperatively not shown characteristic symptoms of chondromalacia. The symptoms of the torn meniscus might have overshadowed possible patellar symptoms.

**Peripheral Vascular Disease**

There were no signs of peripheral vascular disease in any of the patients in this investigation.

**Method**

The patients were operated under general anaesthesia with spontaneous breathing. The drugs used may have an effect on the peripheral circulation but the same were used for both the chondromalacia, osteoarthrosis and control groups. The patients were in the supine position. A minor incision was made over the medial margin of the patella. A Gidlund biopsy needle with 2 mm diameter was drilled 15–20 mm into the bone. A thin baby feeding catheter was introduced into the biopsy needle and the passage was flushed with 0.9% saline solution containing 500 units of heparin per 100 ml. Following this, the catheter was withdrawn and the needle was connected to a pressure recording system (a capacitance transducer–Elema Schöndander) by a polyethylene catheter filled with heparinised saline. Registration was done by means of a Mingograph (Elema). In all cases but one a pulse wave was registered indicating a free connection between the intramedullary circulation and the pressure registering unit. In one patient the pulse wave was disturbed because of technical errors but the pressure level could nevertheless be measured. The reference pressure level was situated 5 cm below the midpoint of the sternum.