



Supplementary Material

10.1302/2046-3758.109.BJR-2021-0031.R1

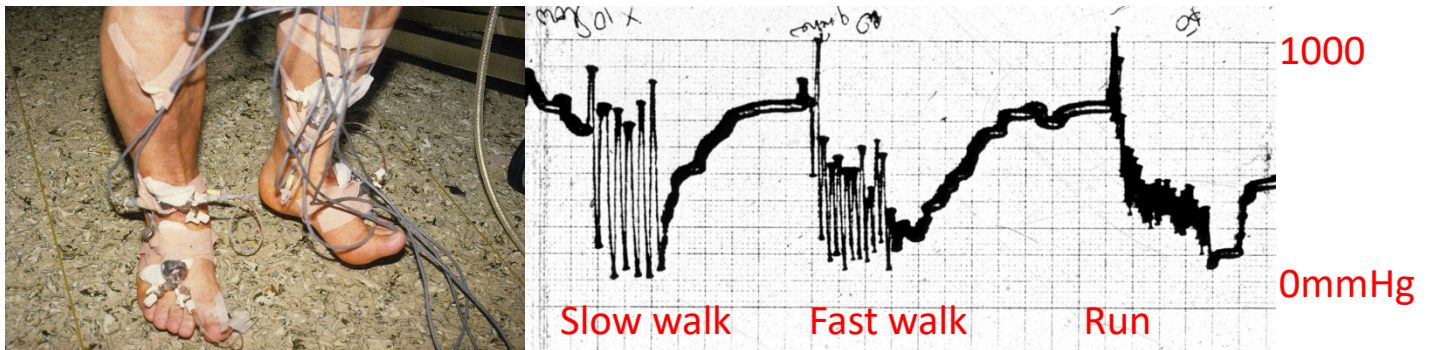


Fig a. At rest intraosseous pressure (IOP) varies, reflecting perfusion conditions at the needle tip. With loading very high fluctuating subchondral IOP occurs. Fat is fluid at body temperature. Load is transferred partly by hydraulic pressure.

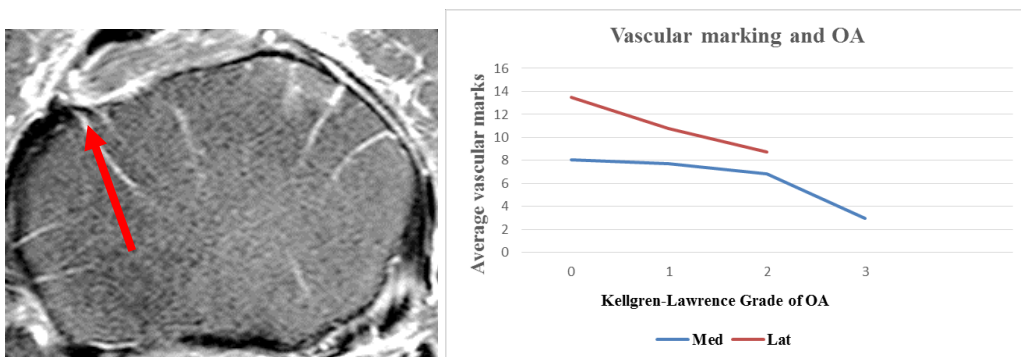


Fig b. There are previously undescribed axial plane subchondral vascular marks on MRI scans, but they are reduced in osteoarthritis (OA).

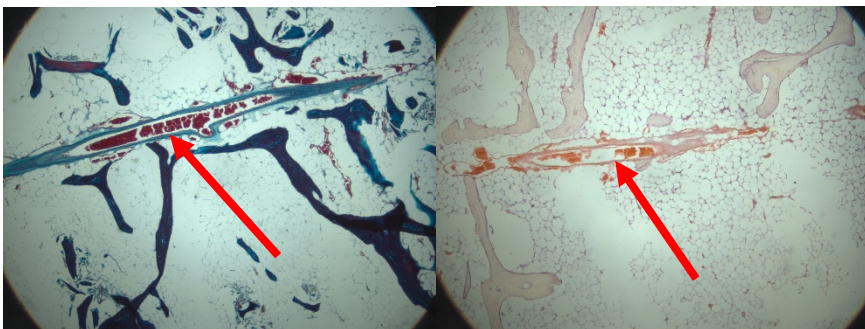


Fig c. Normal upper tibial bone examined in the subchondral plane shows vessels like those seen in the subchondral plane in water bright MRI scans. The vessels are absent in osteoarthritic bone.

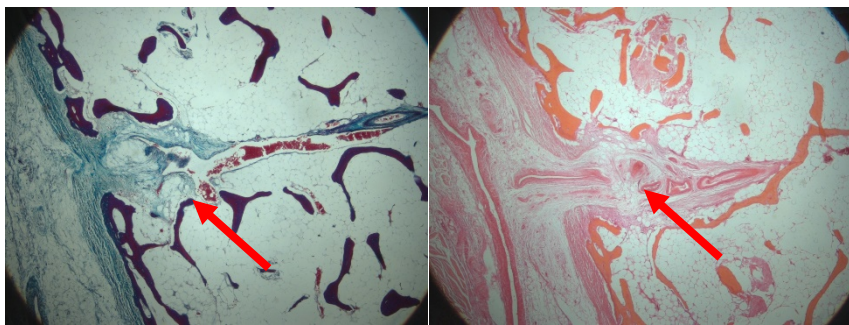


Fig d. Where the vessels penetrate the cortex near the joint margin there are complex choke-valve-like distortions.

Summary

Intraosseous pressure (IOP) only reflects perfusion at the needle tip, but is affected by vascular obstruction and load. High pressures occur under the joint surface. Bone is micro-flexible. Bone fat is oily or fluid at body temperature and acts as a hydraulic pressure transfer medium. Previously undescribed vessels run in the subchondral plane consistent with the marks seen on MRI scans. At the cortical margin, complex distortions exist which act as choke-valves. With a raised surrounding IOP, they close to prevent turbulent flow in and out of the subchondral bone. In osteoarthritis the subchondral vessels and valves are lost. Osteoarthritis is caused by vasculo-mechanical failure.