Joint Fluid Analysis

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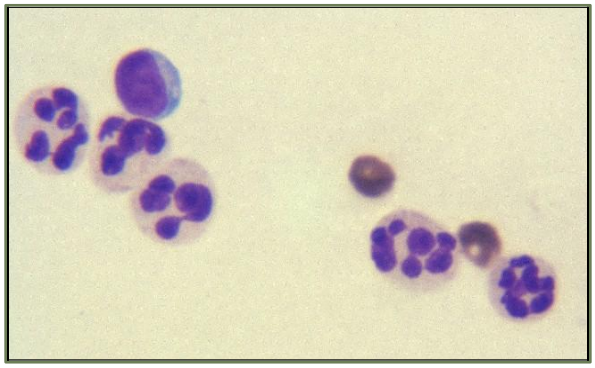
Visual examination: Assess for volume, colour, turbidity and viscosity. A normal shoulder, elbow, hip or stifle will typically provide no more than 0.25 – 0.5 ml of colourless and clear viscous fluid. Collection of more than 0.5 ml of fluid is abnormal. In the smaller joints, and in the larger joints in small patients, it may only be possible to get a drop or two of fluid in the hub of the needle. Iatrogenic blood contamination can usually be recognised since the blood does not mix evenly with the joint fluid. A uniformly pink/red sample suggests recent haemarthrosis. A yellow-orange colour (xanthochromia) indicates prior haemorrhage and haemoglobin breakdown. Turbidity generally indicates a raised cell count (but fluid with an increased cell count can appear clear too). The viscosity of the fluid can be assessed by the 'hanging drop' test (a string of at least 2.5 cm should form before the drop breaks), or by placing a drop between two fingers and gently pulling them apart. More easily the viscosity can be assessed by inverting the fluid back and forth in the syringe. Normal fluid forms a gelatinous mass in the syringe and flows slowly within the syringe, tending to stick to the sides. This can be mistaken for a clot and be a problem for fluid analysis. Shaking the fluid within the syringe/sample tube will return the sample to a fluid state (a property known a thixotropism).

Cytology: The most useful single test is cytological examination. Smears are made soon after collection using two glass slides in a similar manner to fine needle aspirates. Smears can be stained with Diff-Quik and air-dried. If samples are being posted to an external laboratory clearly labelled unstained smears should be sent, along with fluid in an EDTA tube if there is sufficient quantity.

Normal synovial fluid has a low nucleated cell count (NCC, ≤3 x10^9/l). The cell count can be estimated from a x400 high-powered field; each cell in the field represents approximately 1000 cells/ul (or 1 x10^9 cells/l). This is not a particularly accurate assessment of the NCC but is generally accurate at distinguishing inflammatory from non-inflammatory joint disease. Fluid from a degenerate (i.e. osteoarthritic) joint may have a marginally increased cell count but a count greater than 5 x10^9/l, and with >10% neutrophils, is indicative of an inflammatory joint disease. Normal synovial fluid NCC should have <10% neutrophils with the predominant nucleated cell type being mononuclear (lymphocytes, tissue macrophages and synovial cells).



Neutrophils (and a mononuclear cell and a couple of red cells) from a septic joint

It is generally not possible to differentiate between septic and non-septic (e.g. polyarthritis) inflammatory joint diseases on cytological examination alone; fluid from most septic joints contains relatively healthy looking neutrophils and bacteria are rarely seen. If enough fluid is collected, an automated NCC is useful.

Culture: is performed if sufficient joint fluid is collected and sepsis is a differential. Joint fluid can be difficult to culture and incubation in blood culture medium (aprox 1:10 dilution) gives fewer false negative results than culture of fluid directly or culture of synovial membrane biopsies.

	Volume	Viscosity	NCC (x10^9/l)	Mononuclear	Neutrophils
Normal	0.1-0.5ml	High	< 3	≥ 90%	≤ 10%
DJD/trauma	Normal/increased	Slightly reduced	< 5	≥ 90%	≤ 10%
Septic arthritis	Increased	Reduced	> 3	≤ 75%	≥ 25% (us. ≥ 90%)
Immune-med	Increased	Reduced	> 3	≤ 80%	≥ 20% (us. ≥ 80%)

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