



A classification of the features presented in endochondroma, atypical cartilaginous tumours (ACT) and high-grade chondrosarcoma

(Gerrand *et al.* 2025, Acibadem Health Point, 2026; van Langevelde and Smithuis, 2023; Biology Insights, 2025; Thakkar, Deshpande and Janu, 2019; Guney and Qasem, 2024)

Type of test	Features	Clinical outcome for endochondroma	Clinical outcome for grade 1 chondrosarcoma (ACT) Atypical cartilaginuous tumours	Clinical outcome for high grade chondrosarcoma
X-ray Magnetic Resonance Imaging (MRI)	Lytic lesions Definition: areas of bone destruction	No	Yes, there are dark or hollow areas.	Yes
	Margin	Defined and well-contained lesion	Irregular (ill-defined) → invasive	Irregular
	Shape		Lobular	Multilobular
	Size	Smaller than 4 to 5 cm. It is within 2 cm of epiphseal plate in the long bones	Mean tumour length 5.5 cm	Mean tumour length 11.4cm
	Appearance	Homogenous	Homogeneous, moth-eaten appearance on the bone	
	Cortical Scalloping Definition: resorption of the inner layer of the cortex by a slow growing lesion. There is sharp osteolysis extending from the marrow cavity.	No	Yes endosteal scalloping	Yes



X-ray Magnetic Resonance Imaging (MRI)	Features	Clinical outcome for enchondroma	Clinical outcome for grade 1 chondrosarcoma (ACT)	Clinical outcome for high grade chondrosarcoma
	Cortical destruction Definition: tumour focally grows through the cortex.	No, does not reach the cortex.	No	Yes
	Matrix calcification	Yes, popcorn- like appearance	Yes	Yes
	Periosteal reaction Definition: Outer layer presents increased density (T2A hyperintense signal) or new bone formed due to tumour especially around the cortex.	No	No, unless there is a fracture	Yes with bone marrow oedema
	Expansion Definition: widening of the bone.	No	Yes	Yes, more common than ACT
	Soft tissue mass	No	No	Yes In advanced cases of chondrosarcoma. It extends more than the bone, build up of fluid in the bone marrow (oedema), increased radiotracer uptake.
	Entrapped/Interpersed fat mass Description: It is present between cartilage nodules. The more fat, the less nodules remain.	No	Yes	No
	Septonodular enhancement Definition: rings-and-arcs enhancement	No	Yes	Yes



	Features	Clinical outcome for enchondroma	Clinical outcome for grade 1 chondrosarcoma (ACT)	Clinical outcome for high grade chondrosarcoma
X-ray Magnetic Resonance Imaging (MRI)	Dynamic contrast enhancement (Perfusion)	Yes	Yes, fast dynamic contrast enhancement, if there is a fracture surrounded with oedema (build up of fluid and periosteal reaction).	Yes, fast dynamic contrast enhancement
	Definition/Description: Monitors early enhancement of a tumour after an injection of intravenous gadolinium contrast. The purpose of this contrast agent is to assess the arrival and clearance of the agent over time. Fast images help take resolution images every 2 to 3 seconds. Contrast washes in and out of the tumour takes 3 to 5 minutes. The procedure ends with static post contrast sequences in 2 different planes. It helps provide information on vascularisation (blood vessels including capillary permeability and the fluid between the tissues/cells (interstitial))		This must coorelate with clinical history of trauma and another MRI in 3 to 6 months to compare and resolve findings.	



Type of test	Features	Clinical outcome for enchondroma	Clinical outcome for grade 1 chondrosarcoma (ACT)	Clinical outcome for high grade chondrosarcoma
X-ray Magnetic Resonance Imaging (MRI)	Osteolysis Definition: lucent area with no matrix calcification due to presence of mucoid. It is hyperintense on fluid sensitive sequences, fat suppression and no contrast enhancement	No	No	Yes
Histopathology under the microscope	Type of cells	Mature chondrocytes	Atypical cartilage forming cells	atypical cells
	Presence of cartilage	Yes, islands of mature hyaline cartilage		
	Presence of chondrocytes	Scattered but well defined surrounded by extracellular matrix	Variable of cells and affects matrix	Variable of cells and affects matrix in lacunae
	Nuclear features	Yes, uniform	Yes, pleomorphism (different form)	Yes, pleomorphism (different form)



Histopathology under the microscope	Features	Clinical outcome for enchondroma	Clinical outcome for grade 1 chondrosarcoma (ACT)	Clinical outcome for high grade chondrosarcoma
	Cellular atypia	No	Yes Varies by grade Grade I: minimally increased cellularity, nodular growth and occasional binucleate nuclei Grade II: moderate cellularity and diffuse growth. Grade III: high cellularity, marked atypical cells, pleomorphic appearance and high mitotic activity.	Yes
	Mitotic activity	No	Yes, varies by grade	Yes
	Calcification		Yes	Yes
	Cartilaginous matrix		Yes	Yes
	Grading	No but if there is a cellular atypia or malignancy, needs to be identified.	Grade 1, II, and III	Grade III