

## Introduction and objectives

- ✓ Extradural spinal tumours are the most frequent type of spinal tumours in dogs, and bone neoplasms are highly overrepresented.
- ✓ Clinical signs are caused by focal compression or invasion of the spinal cord, mostly showing pain and neurological deficits, and most of the times they carry a very poor prognosis.
- ✓ Diagnosis of such tumours relies basically on histopathological studies, although their microscopic appearance is very similar and useful diagnostic biomarkers are lacking.
- ✓ This review intended to shine some light into canine extradural bone tumours and analyse several histologic biomarkers that could aid during diagnosis.

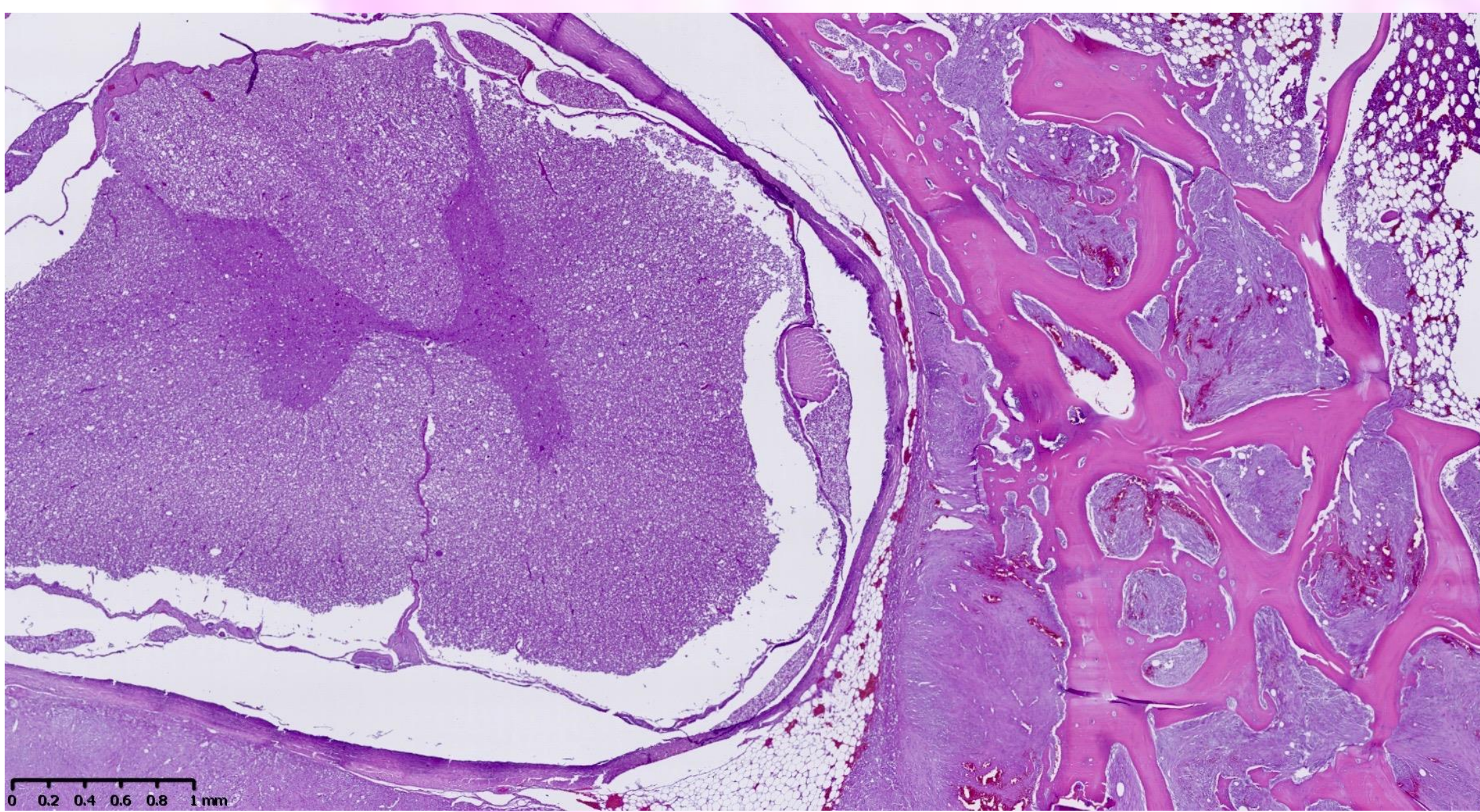


Fig 3. Haematoxylin and eosin staining of a bone fibrosarcoma. (Courtesy of the Mouse and Comparative Pathology Unit, UAB).

## Main extradural spinal tumours

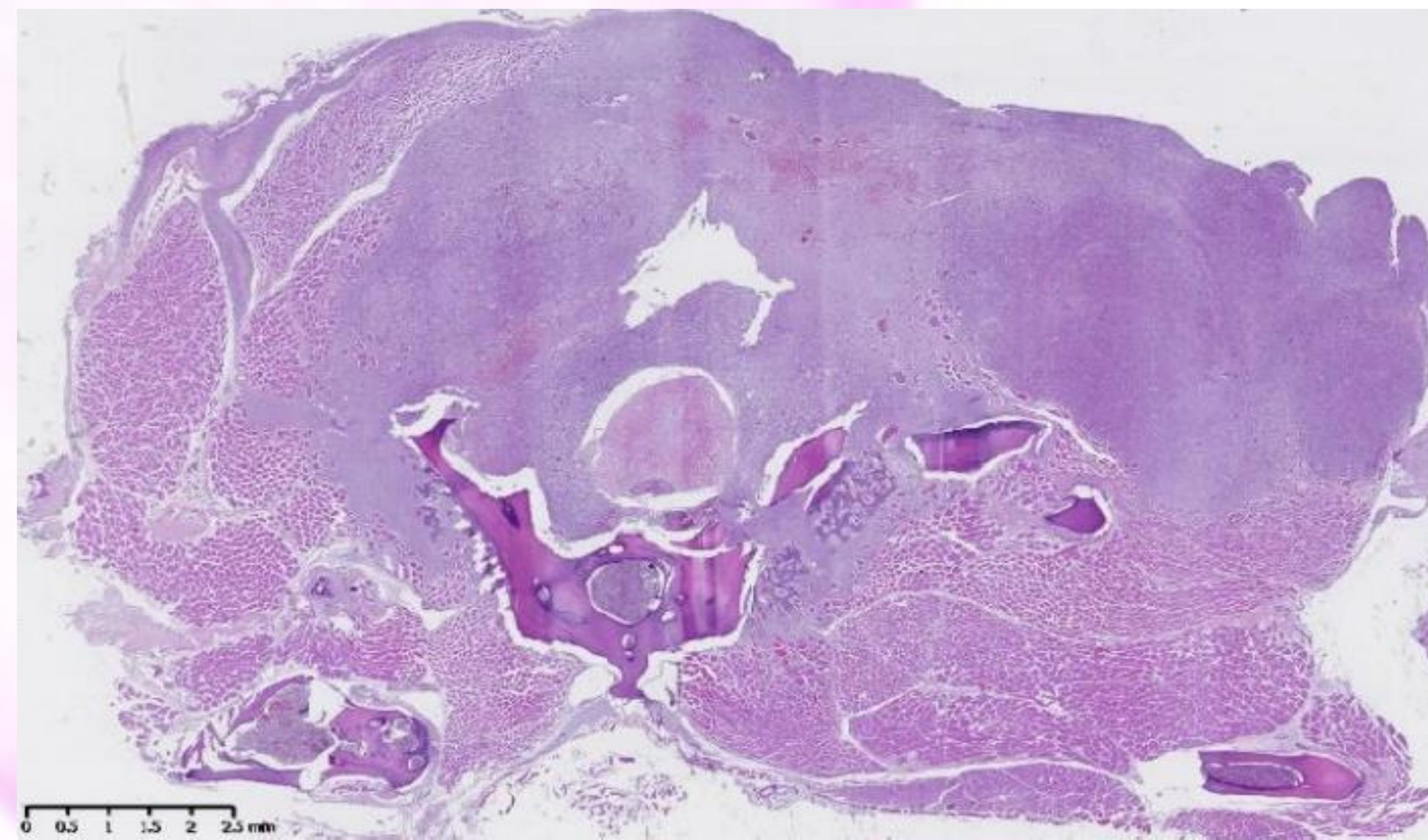


Fig 1. Haematoxylin and eosin staining of a vertebral osteoblastic osteosarcoma. (Courtesy of the Mouse and Comparative Pathology Unit, UAB).

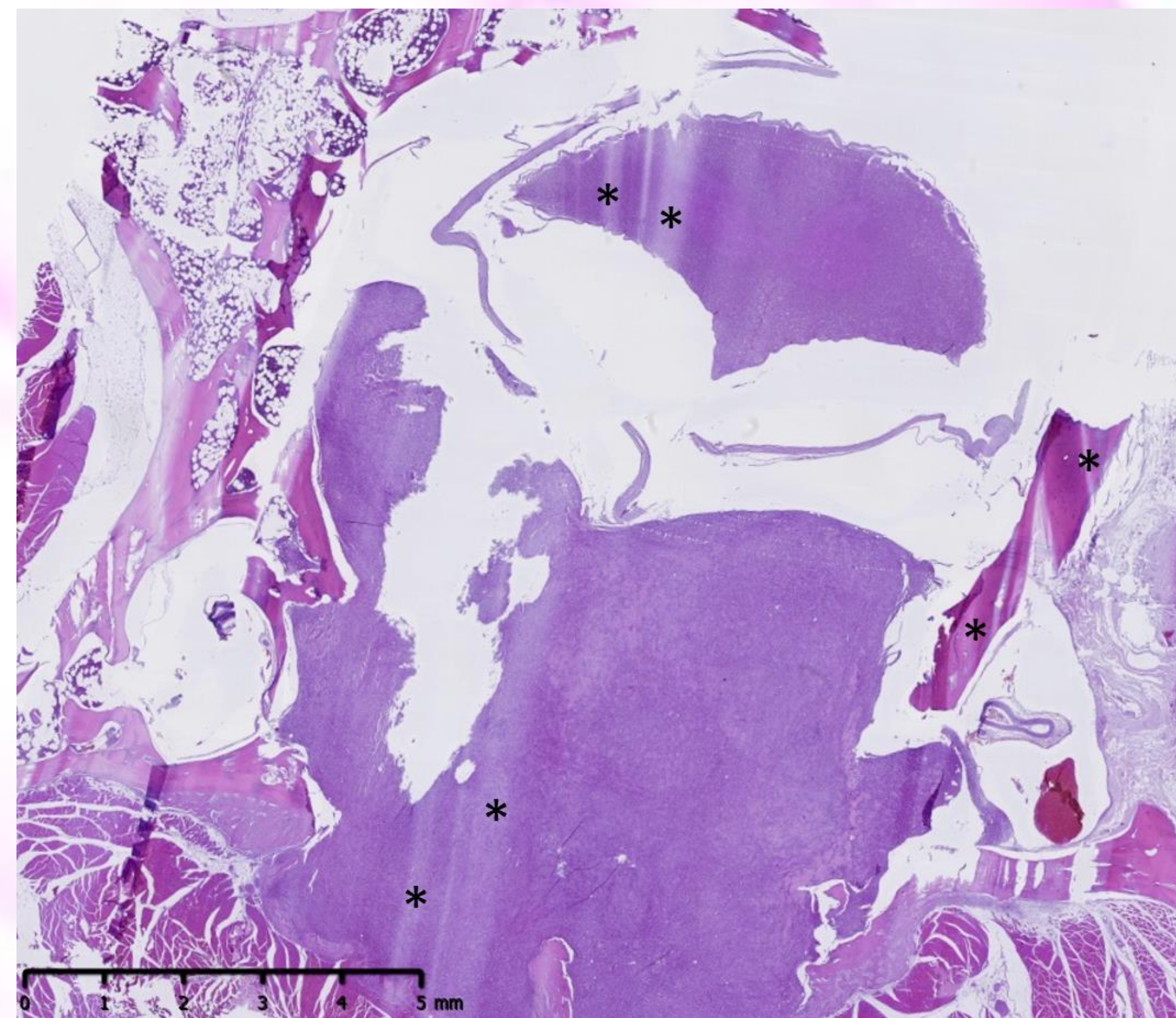


Fig 4. Haematoxylin and eosin staining of an osteoblastic osteosarcoma. Note the striped artefacts caused by decalcification and sample processing (\*). (Courtesy of the Mouse and Comparative Pathology Unit, UAB).

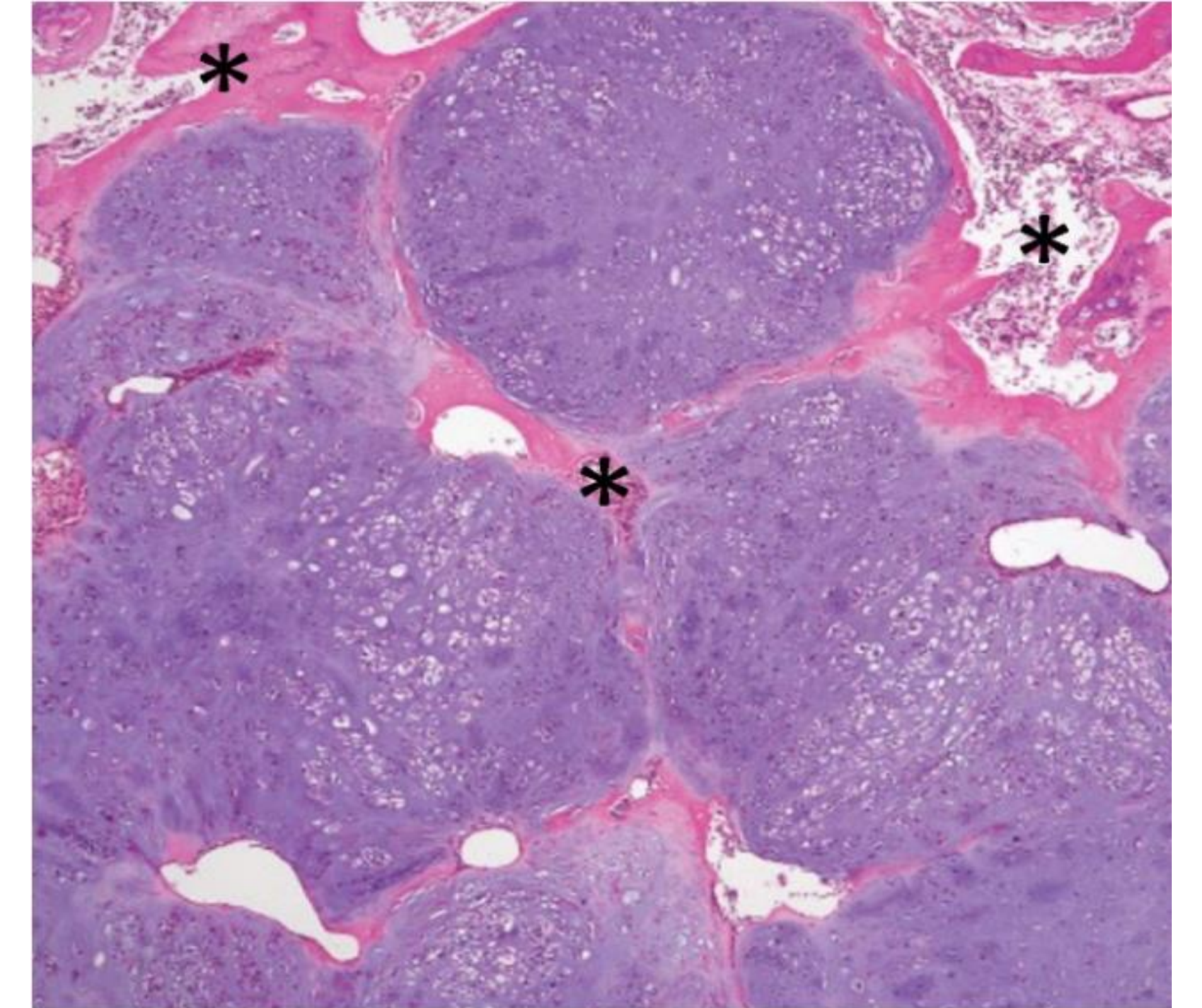


Fig 2. Haematoxylin and eosin staining of a chondrosarcoma. (From Thompson KG, Dittmer KE. 2017. Tumors of bone. In: Meuten DJ, editor. Tumors in domestic animals) <sup>1</sup>.

Table 1. The three most common bone tumours, their incidence and histologic subtypes. Modified from Thompson and Dittmer et al. (2017).

Osteosarcoma (85%)	Central and periosteal: poorly differentiated, osteoblastic, chondroblastic, fibroblastic, telangiectatic and giant cell-rich
Chondrosarcoma (10%)	Central, periosteal and extraskeletal
Bone Fibrosarcoma (5-9%)	Central, periosteal and mandibular or maxillary bone fibrosarcoma of the dog

## Diagnostic and prognostic biomarkers

- ✓ **Vimentin** indicates mesenchymal origin. Low immunoreactivity correlates with better prognosis.
- ✓ **Alkaline phosphatase** is present in all osteoblasts. Elevated serum levels indicate poor prognosis.
- ✓ **Osteocalcin** is a late osteoblastic differentiation marker. Loss of expression indicates poor prognosis.
- ✓ **Ezrin** and **Galectin1** may distinguish osteosarcomas from chondrosarcomas.
- ✓ **Snail2** is a promoter of osteoblastic differentiation. Prognostic implications in appendicular osteosarcomas.
- ✓ **STAT3**, **TP53** and **c-MET** indicate malignancy.

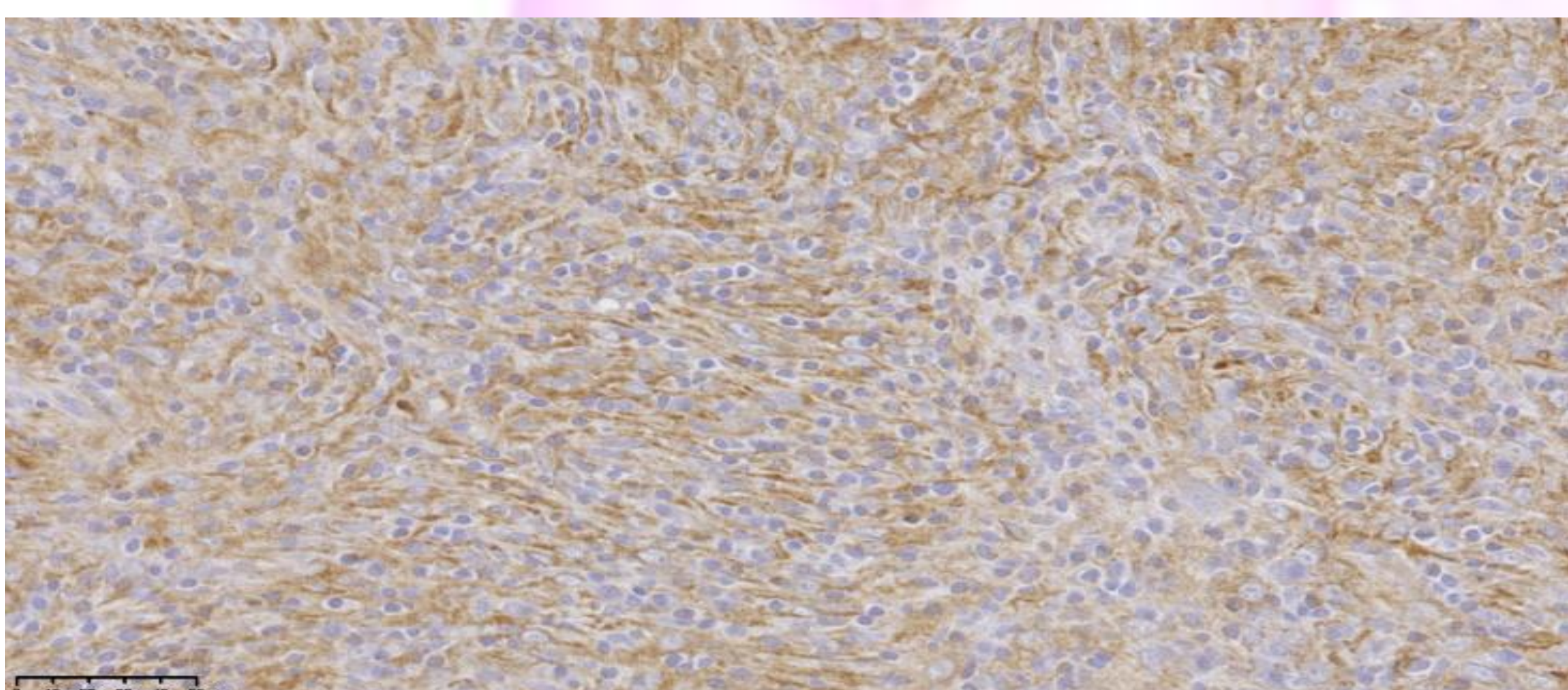


Fig 5. Vimentin immunohistochemistry labelling. (Courtesy of the Mouse and Comparative Pathology Unit, UAB).

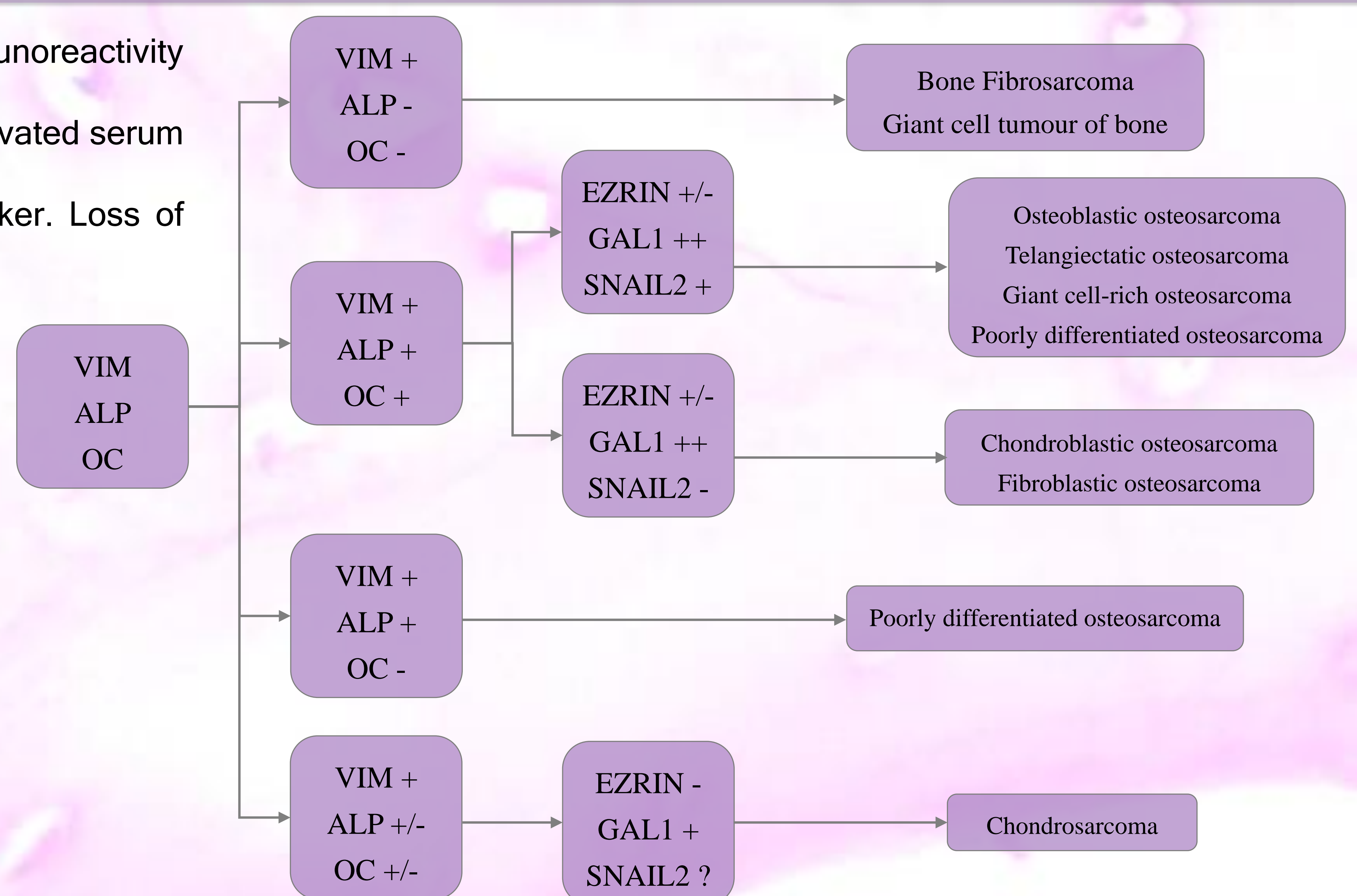


Fig 6. Algorithm to canine spinal bone neoplasia using immunohistochemical biomarkers. VIM Vimentin, ALP Alkaline phosphatase, OC Osteocalcin, GAL1 Galectin-1.

## Conclusions

- ✓ Diagnosis of extradural spinal bone tumours is currently a very difficult task that relies mainly in immunohistochemistry and diagnostic biomarkers.
- ✓ Decalcification procedures are compulsory for this type of studies and may alter the obtained results.
- ✓ Further investigation is needed in search for more reliable biomarkers, especially those able to distinguish among osteosarcoma and chondrosarcoma, since they are the two most common bone tumours in dogs.
- ✓ If more concrete diagnosis are reached, more accurate epidemiological studies should be performed to gain a bigger picture of canine extradural spinal neoplasms.

## References

1. Thompson KG, Dittmer KE. 2017. Tumors of bone. In: Meuten DJ, editor. Tumors in domestic animals. 5<sup>th</sup> ed. Ames: Wiley-Blackwell. p. 356-424