

EVALUATION OF CONTRAST ENHANCED ULTRASONOGRAPHY (CEUS) IN CANINE MAMMARY GLAND TUMOURS

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Abstract

Contrast enhanced ultrasonography (CEUS) is a non-invasive method of examination that surpassed the normal standard B-Mode and Doppler ultrasonography (US). The use of contrast agents (CA) allows the examiner to observe a more detailed map of the tumor vascularization. The aim of this study was to establish the advantages and disadvantages of this method. The study was conducted on 5 canine patients, different breeds with the the age between 8 and 12 years. Each patient was presented with a mammary tumor and evaluated through a standard US. The CEUS examination was performed after injecting intravenously, in bolus, 1 ml/10 kg of prepared UCA SonoVue (8 µl/ml sulphur hexafluoride microbubbles, Bracco, Italy). A 3-minute recording was saved after the administration and afterwards evaluated. The results were satisfactory, but the small mammary nodules were not only hard to examine but did not show a difference from the B-Mode US. The advantages were clear in the larger and more aggressive tumors and a layout of the neovascularization was quite clear. In conclusion, at this stage of the study the disadvantages outweigh the advantages and further investigations are needed.

Keywords: CEUS, SonoVue, tumors, vascularization

Introduction

Contrast enhanced ultrasonography (CEUS) is a non-invasive method of examination that surpassed the normal standard B-Mode and Doppler ultrasonography (US) and with the use of contrast agents (CA) it allows the examiner to observe a more detailed map of the tumor vascularization.

Angiogenesis is defined by the formation of new vessels from the existing ones and regulated by factors that stimulate and inhibit the process. In tumors, the balance between these factors is shifted, increasing the stimulating factors and resulting a rise in angiogenesis (Restucci B., 2002). This is an important process in tumor growth, invasion and metastasis.

Studies show that breast carcinoma is an angiogenesis-dependent tumor (Gasparini G, 2000) and so the reason for choosing this particular method to evaluate was to see if a noninvasive examination can establish the extent of vascularization and neoangiogenesis in a mammary gland tumor.

The aim of this study was to establish the advantages and disadvantages of the CEUS method.

Materials and methods

The study was conducted on 5 canine patients, different breeds with the the age between 8 and 12 years. Each patient was presented with a mammary tumor and evaluated through a standard US in the Clinical Reproduction Department at the Faculty of Veterinary Medicine, USAMV Cluj Napoca. Two patients, a Dachshund and a Poodle, age 9 and 10 years old (cases 1 and 2), presented small, oval mammary nodules. The nodules were dense in consistency, mobile and localized both in the second abdominal mammary gland. The other three patients, two common breeds (cases 3 and 4) and one Caucasian Shepard (case 5) presented large mammary gland masses, between 6 and 10 cm wide. The common breeds were 10 and 12 years old, the Caucasian Shepard was 8 years old and had 3 litters. The first 4 females had no litters in their history.

The US examination was performed using a Mindray DC3 Vet equipment with an 8 MHz transducer and an Esaote MyLab™40 VET system and a linear transducer with a 7.5 MHz

frequency. Each patient was examined in B-Mode and Doppler US to establish a region of interest (ROI).

The CEUS examination was performed using an Esaote MyLab™40 VET system and a linear transducer with a 7.5 MHz frequency. The interpretation of CEUS is by analyzing the time the CA arrives in the tissue (AT – arrival time), the time the CA remains (EI - enhancement intensity), peak intensity (PI - the maximum value of the contrast agent) wash in (the point where it can be observed a constant rise until EI; units/seconds) and wash out (from EI a constant decrease of contrast; units/seconds).

To each patient was administrated intravenously, in bolus, 1 ml/10 kg of prepared UCA SonoVue (8 µl/ml sulphur hexafluoride microbubbles, Bracco, Italy). A 3-minute recording was saved after the administration and afterwards evaluated.

Results and discussion

The first two cases presented a small mammary nodule and the US examination showed a small hypoeogenic, almost anecogenic, mass (*figure 1 A*). The nodules were homogenous with a poor vascularization. After CEUS the results we previously obtained can be confirmed. Intratumoral vascularization is practically nonexistent, but the tumor capsule is evident (*figure 1 B*). In these cases, the wash in and wash out of the CA can be clearly observed in the surrounding tissues but not in the tumor. CEUS did not show an obvious difference from the classic US.

The two cases, 3 and 4, presented large mammary masses and the B-Mode US showed very heterogeneous tumors. The hypoeogenic areas seen in the left side of the image are cystic structures, that are surrounded by ecogenic tumor parenchyma and hyperecogenic connective tissue (*figure 2 A*). CEUS analysis showed a low wash in and a quick wash out of the CA and that means a very high grade of vascularization and malignancy. The intratumoral vascularization can be seen clearly (*figure 2 B*).

The last case (5) had an enlarged tumor-like mammary gland, that in standard US can be seen as a anecogenic polycystic structure that is not perfectly delimited (*figure 3 A*). The cystic structures are separated by a hyperecogenic connective tissue, that is obviously vascularized. This aspect ca be confirmed and observed in CEUS, where the CA is present, but in the cystic structures is not (*figure 3 B*).

The first advantage of this US technique is that this noninvasive method can show, in real time, not only the small and medium blood vessels, but the microcirculation as well.

The CA SonoVue has several applications besides breast and liver microcirculation, such as cardiovascular (in which it provides opacification of cardiac chambers and enhances the left ventricular endocardial border delimitation), radiological and to investigate abnormalities in cerebral arteries and extracranial carotid or peripheral arteries (Correas JM, 2001). Besides its vast applications this contrast agent is very safe and no side effects were reported. The disadvantage is that this agent is quite expensive and is stable for only 6 hours after reconstitution, so the cases need to be scheduled within that range of time.

Another advantage of this method is that the patient does not need to be under general anesthesia, a good thing for the older patients. But at the same time the disadvantage is that the animal cannot stay perfectly still for a long period, so in the time the video of 3 minutes is recording the transducer sometimes moves and the sections of ROIs are modified.

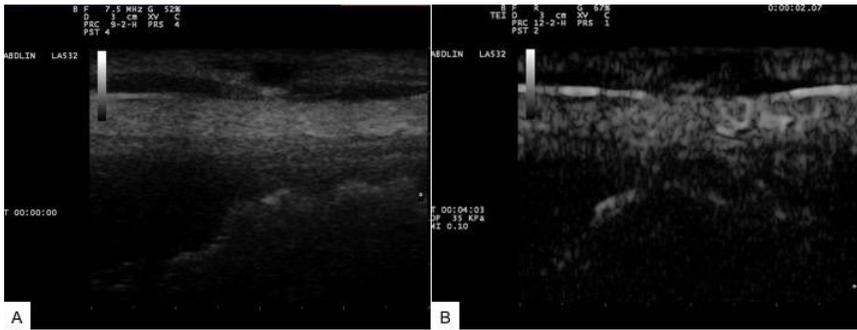


Figure 1 US and CEUS on a small mammary tumor

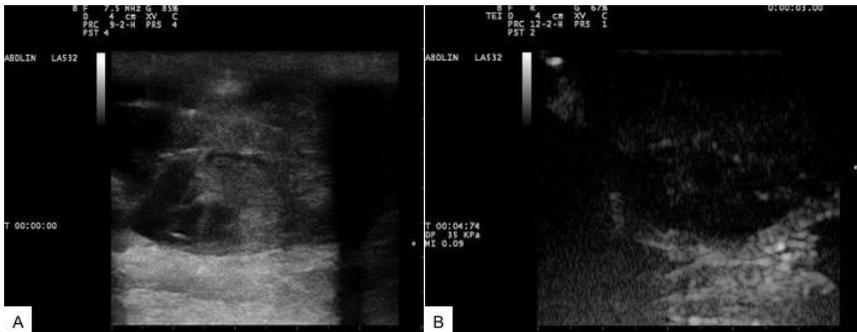


Figure 2 US and CEUS on a large mammary tumor

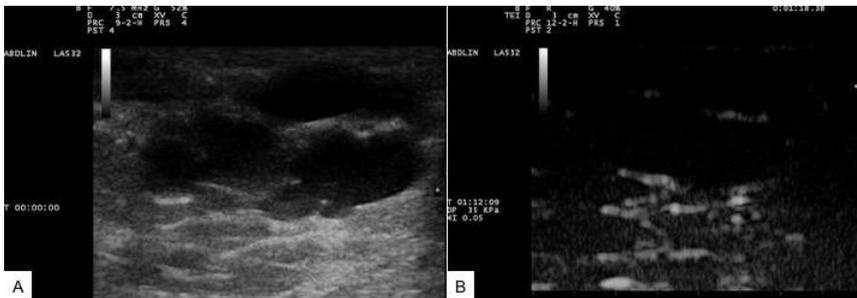


Figure 3 US and CEUS on a case diagnosed with polycystic mastosis

Conclusions

The more important negative part of this method is that the small nodules did not show, after CEUS, a difference from the standard US. And so, you cannot obtain the information that can be further useful in establishing the malignancy potential.

At this stage of the study the disadvantages outweigh the advantages and further investigations are needed and of course correlated with the histopathology.

References

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