THORACIC ULTRASOUND IN THE INTENSIVE CARE UNIT

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Focused abdominal sonography for trauma (FAST) is a rapid, non-invasive, and highly accurate diagnostic tool that identifies life-threatening accumulations of blood and other intra-abdominal fluids following trauma in people (Schulman 2003). In human medicine, FAST performed by emergency medicine trained clinicians with minimal ultrasonography skills is rapidly becoming the initial diagnostic tool of choice for blunt abdominal trauma. Multiple hand-carried personal ultrasound devices have been developed especially for this purpose. In many countries this facility is available in the ER and even in the ambulance/helicopter (Melanson 2001, Walcher 2002).

Because the technique is being used by people with no prior ultrasonography education minimal training guidelines (Salen 1999) have been established prior to credentialling an ER clinician in this technique.

Only recently a FAST protocol has been established and evaluated in dogs (Boysen 2003). A study of 100 dogs presented to Tufts University school of Veterinary Medicine after a motor vehicle trauma compared ER clinician FAST results with the interpretation of the sonographic images by a board-certified radiologist. The detection of free fluid had a sensitivity of 96% and a specificity of 100 %. It was concluded that also in dogs the FAST exam is a rapid test that can be performed on dogs in the ER by clinicians with minimal prior sonographic training.

The focused assessment with sonography of the thorax ($FAST_X$) is also recognised as a clinically useful objective means in people for screening for haemothorax or haemopericardium after blunt force trauma (Rozycki 1996). At the other hand emergency bedside ultrasound is now used for the detection of pneumothorax (Chan 2003).

On the top of that, the value of these hand-carried personal devices for rapid evaluation of left ventricular function after limited echocardiography training has now also been established in human emergency medicine (Lemola 2003).

Very little is known and published about the use of ultrasonography for thoracic evaluation in the veterinary emergency room. Only the fact that at least minimum echo training is required for non-invasive assessment of left ventricular function in dogs by ultrasonography and that the technique should not be used by people with no prior echocardiography education has been documented (Van Israël 2006).

Dyspnoea is a common clinical presentation in the veterinary ER/ICU and any diagnostic aid (pleural effusion or not/ pneumothorax or not/ pericardial effusion or not/ heart failure or not) will contribute to better treatment guidance and hopefully higher survival rates in the hands of relatively inexperienced clinicians.

Despite ultrasound machines having become less complex and more user-friendly over the years, understanding the basic physics and making maximum use of the controls ('knobology') remains an essential part in the creation of interpretable images.

Decent patient preparation (clipping hair, degreasing skin, abundant amount of coupling gel) will improve the quality of the images. Sedation should be avoided, however multiple safe sedation protocols are available for critical animals with minimal stress tolerance. If the examination will take a long time sedation is preferred over forced

restraint. Dyspnoeic animals (definitely cats) should always be stabilised prior to a prolonged examination.
For thoracic ultrasonography linear array probes can be used (although sector probes or phased array probes are preferred) as long as their head width does not exceed the intercostal space width. Fluid is a very good beam enhancer and will hardly return any echoes (black field in the image). In the normal thorax nearly no free fluid (pleural effusion) can be visualised. However, in the presence of free fluid it often demands advanced ultrasonography skills to localise its origin (pleural, mediastinal, pericardial). Air and bone reflect all sound (no image-white) and are therefore the major obstacles for decent thoracic ultrasonography. However the detection of free air in the thorax can be diagnostically helpful in the dyspnoeic animal (for the diagnosis of a pneumothorax).
Echocardiography requires a sector transducer or a phased array probe in order to create a window between ribs and between lung lobes. A 5 MHz transducer is suitable for most small animals. The possibility of M-mode measurements should be provided. Higher frame rates give better cardiac images. An echo table will permit scanning through the dependant thoracic wall and avoid lung interference.
In echocardiography a standard technique is followed to ensure that all chambers and structures are evaluated (Dukes-McEwan 2004). Surfing randomly is strongly discouraged. Most of the echocardiographic examination is carried out from the right parasternal view with the animal in right lateral recumbency. Reference values have been published for many breeds and weight-dependent tables are available for interpretation of the obtained values (Boon 1998).
$FAST_X$ might become an extension (and not a replacement!) of the stethoscope and help saving lives by making a more accurate diagnosis and treatment decisions in the critical animal. However, the veterinary ER clinician should be aware that the clinically focused sonogram is performed to answer a specific clinical question (pleural effusion or not, pericardial effusion or not, pneumothorax or not, myocardial dysfunction or not?) and that it is technically distinct from comprehensive diagnostic ultrasonography in which a host of clinical questions or diagnosis are often entertained (Schackford 1993) and which requires extensive training in a specialist institution.

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