

Detection of Blood by MRI – An in Vitro Study

Usiakimi Igbaseimokumo MBBS FRCS(SN) FRCSC MD; Neil Mardis MD; Laszlo Nagy; Timothy Zinkus MD; David Nielsen MD; Roy Jacob MD; Lejla Music-Aplenc MD

Introduction

It has been observed that there are limitations to the detection of subdural blood by various available MRI sequences even blood that is macroscopically evident at surgery. This experiment was therefore carried out to determine the threshold concentration that the MRI maybe able to detect blood.

Methods

Expired blood from the blood bank was obtained and the hematocrit was determined in the standard fashion. The blood was then serially diluted and the again the hematocrit determined again in each of the serially diluted specimens and they were placed in 1-inch wide test tubes and scanned in a 3 tesla MRI. The images were then reviewed and the signal intensity in each sample was measured 3 times using the region of interest function and the average calculated for each sample. The MRI technologist and radiologist were blinded to the concentrations of blood in the test tubes.

Results

Visual inspection showed that confident determination of the presence of blood could only be made at concentrations over 40% hematocrit. However, there was a strong correlation of the concentration of red cells in each sample with the signal intensity with a positive correlation coefficient (r^2) of 0.99 in the T1W images and a negative correlation coefficient of 0.99 in the ADC sequence

Conclusions

The findings confirm the clinical observation that MRI lacks sensitivity in detecting blood especially in the subdural space. Further studies are needed to quantify the sensitivity of MRI when CSF dilutes subdural blood in vivo.

Learning Objectives

Highlight the limitation of MRI in detecting blood in the subdural space. Show the correlation of signal intensity and blood concentration highlighting that there is no clear cut-off point.

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