Effect of Standing Waves in Signal to Noise Ratio Measurement

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INTRODUCTION. Man y studie s regardin g S/ N measurement s i n NM R d o no t conside r th e loss o f signal du e t o th e effect o f standing waves . W e have found som e discrepancies betwee n our experimental measurements and th e theoretically predicted ones. Ou r hipothesis is tha t th e source of the discrepancy lies on th e presence of standing waves, which may alter the values of signal and noise depending on the distance between th e area we are measuring in and the centre of the phantom.

METHODS AND RESULTS. Henkelman [1] established a theoretical model of noise in NMR and obtained a relationship betwee n th e signa l mean *(u)* and th e standard deviation (o~), namely |u/G = 1.253 , provided fi and **a** are measured in uniform areas of the object and th e surrounding air.

Our purpose was t o verify Henkelman's predictions i n practice, but our results were not in full agreement with them. Ou r experiment made use of a large water phantom in a PHILIPS 1. 5 T Gyroscan. Tabl e 1 show s our experimental values for the signal and its standard deviation, and the error percentage with respect to the theoretical noise model.

	µAir	σObject	µ/σ	Error %
image1	6.80	6.70	1.01	8%
image2	6.65	6.00	1.11	9%

From the Maxwell's equations solution developed by Glover and Tofts [2,3] th e existence of a standing wav e effec t i s deduced. A s a consequence, th e signa l decrease s a s th e radi o grows, giving a loss of about 10 % fo r 1.5 T at a radius of 9.5 cm . Therefore , th e detected deviation with respect to the theory could be explained to a great extent by the standing waves effect.

CONCLUSIONS. Th e standin g wave s effec t shoul d b e take n int o accoun t whe n performin g signal and noise measurements in large liquid phantoms. Areas for signal and noise measurement should b e placed nea r th e cylinde r centre, wher e th e effec t i s no t s o important . Henkelman' s model o f noise holds properl y an d i s i n accordanc e with ou r data onl y i f the effec t o f standing waves is not neglected.

REFERENCES

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