EPOS™ Electronic Presentation Online System

ESR European Society of Radiology

Characterisation of liver nodules in patients with chronic liver disease by MRI: comparison between the LI-RADS v2014 and the Likert scale

Poster No.:	C-2579
Congress:	ECR 2017
Type:	Scientific Exhibit
Authors:	V. Buscarino, A. Esposito, D. Raciti, E. Casiraghi, L. V. Forzenigo, M. Manini; Milan/IT
Keywords:	Liver, Oncology, Abdomen, MR, Decision analysis, Cancer, Cirrhosis, Tissue characterisation
DOI:	10.1594/ecr2017/C-2579

Aims and objectives

The usage of imaging techniques, such as CT or MRI, can detect small liver nodules. An accurate diagnosis is extremely important to improve patient management and avoid more invasive examinations as FNB samples [1]. In order to standardise the reporting LI-RADS (Liver Imaging Reporting and Data System) [2] has been adopted by many clinical practices since March 2011. It categorises nodules with a score from 1 to 5 by using fixed criteria [2]. A different scale of diagnostic interpretation, adopted in many fields of research, is the Likert. It is a psychometric scale and consists in setting up a number of items (1 to 5 or 1 to 7) that evaluate and describe the attitude of the liver nodule towards the HCC [3, 4] by using diagnostic guidelines but not fixed criteria. Our purpose in this study was to compare the performance in the evaluation of liver nodules in high-risk patients within two groups of readers, one using LI-RADS v.2014 and the other using the 5-level Likert scale.

Methods and materials

We reviewed patients with cirrhosis, with no history of previous HCC, who underwent a MR examination between February 2006 and March 2012 for the presence of new nodules. We identified 39 patients (15 males and 14 females) found with a total of 44 lesions. Images were analysed independently by four radiologists (two couples) with different expertise in liver MRI: one group was made by 1-month (IradioLIR) and 10-year (EradioLIR) experienced radiologists, while the other pair was made by 3-month (IradioLik) and 20-year (EradioLik) experienced radiologists. The first couple used the LI-RADS v.2014, the second one adopted the Likert scale (scores 1-5). The reference standard used was, in some instances, histopathological evaluation (72.7% of lesions) and, in others, a 4-year MRI follow-up (27.3% of lesions). Statistical analysis was performed and accuracy, sensitivity, specificity, PPV, NPV, ROC curves and inter-observer agreement were calculated.

Results

We evaluated 44 liver lesions: 26 HCC and 18 non-HCC. As for the LI-RADS v.2014, when the two radiologists gave different scores, the score difference was never higher than 1. Overall, the 77.27% of all the lesions achieved the same score. The k coefficient between the two evaluators of LI-RADS scale was 0.89, while the estimated Pearson correlation coefficient equaled 0.90. As far as the Likert scale is concerned, the inter-reader agreement was much lower, and some nodules were classified with a 3-point score difference. Overall, the 50% of all lesions were classified with equal scores. In this case the k coefficient and the Pearson correlation coefficient were k=0.69 and Pearson=0.63, respectively. Moreover, the readers of the LI-RADS scale obtained the following results: ACC=0.80, SENS=0.72, SPEC=0.93, PPV=0.93, NPV=0.70, AUC=0.85. As for the Likert, the results were: ACC=0.79, SENS=0.73, SPEC=0.87, PPV=0.89, NPV=0.70, AUC=0.83. By applying the z-test to check a statistically significant difference between the performance achieved by readers, the results have shown that there is no a statistically significant difference between the two scales.

Images for this section:

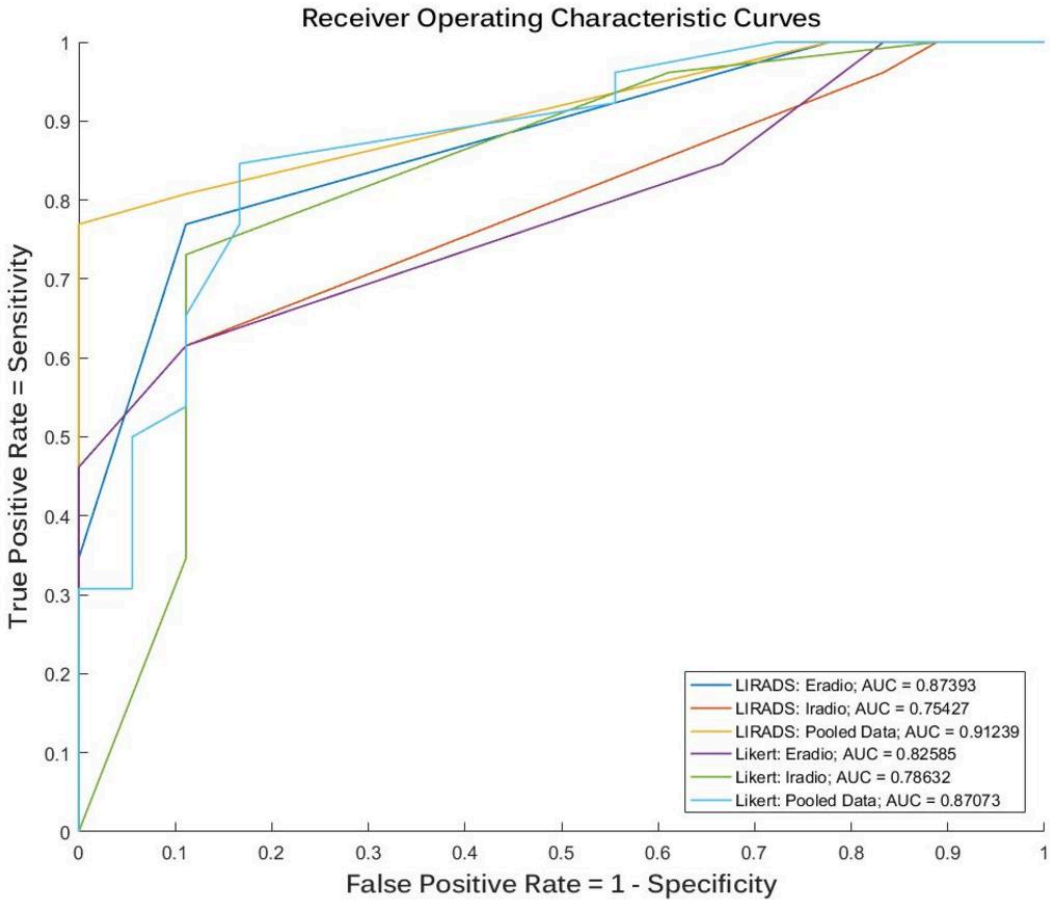

Fig. 1: ROC curve for each evaluator

LIRADS Scale									
Eradio LIRADS	AUC	0,87							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5]	0,61	0,35	1,00	1,00	0,51	9	18	0	17
score>=[4]	0,82	0,77	0,89	0,91	0,73	20	16	2	6
score>=[3]	0,68	1,00	0,22	0,65	1,00	26	4	14	0
score>=[2]	0,64	1,00	0,11	0,62	1,00	26	2	16	0
score>=[1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0
Iradio LIRADS	AUC	0,75							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5]	0,57	0,35	0,89	0,82	0,48	9	16	2	17
score>=[4]	0,73	0,62	0,89	0,89	0,62	16	16	2	10
score>=[3]	0,64	0,96	0,17	0,63	0,75	25	3	15	1
score>=[2]	0,64	1,00	0,11	0,62	1,00	26	2	16	0
score>=[1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0
Pooled Data: Eradio+Iradio LIRADS	AUC	0,91							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5,4]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5,4]	0,43	0,04	1,00	1,00	0,42	1	18	0	25
score>=[5,5]	0,61	0,35	1,00	1,00	0,51	9	18	0	17
score>=[4,3]	0,70	0,50	1,00	1,00	0,58	13	18	0	13
score>=[4,4]	0,84	0,73	1,00	1,00	0,72	19	18	0	7
score>=[3,2]	0,86	0,77	1,00	1,00	0,75	20	18	0	6
score>=[4,5]	0,84	0,81	0,89	0,91	0,76	21	16	2	5
score>=[3,3]	0,68	1,00	0,22	0,65	1,00	26	4	14	0
score>=[2,2]	0,66	1,00	0,17	0,63	1,00	26	3	15	0
score>=[2,3]	0,64	1,00	0,11	0,62	1,00	26	2	16	0
score>=[1,1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0

Fig. 2: LIRADS table: Performance values for each observer score. *NaN: Not a Number.

Likert Scale									
EradioLikert	AUC	0,79							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5]	0,68	0,46	1,00	1,00	0,56	12	18	0	14
score>=[4]	0,73	0,62	0,89	0,89	0,62	16	16	2	10
score>=[3]	0,64	0,85	0,33	0,65	0,60	22	6	12	4
score>=[2]	0,66	1,00	0,17	0,63	1,00	26	3	15	0
score>=[1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0
IradioLikert	AUC	0,83							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5]	0,57	0,35	0,89	0,82	0,48	9	16	2	17
score>=[4]	0,80	0,73	0,89	0,90	0,70	19	16	2	7
score>=[3]	0,73	0,96	0,39	0,69	0,88	25	7	11	1
score>=[2]	0,64	1,00	0,11	0,62	1,00	26	2	16	0
score>=[1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0
Pooled Data: Iradio+EradioLikert	AUC	0,87							
Score	ACC	Sens	Spec	PPV	NPV	TP	TN	FP	FN
score>[5,5]	0,41	0,00	1,00	NaN*	0,41	0	18	0	26
score>=[5,5]	0,59	0,31	1,00	1,00	0,50	8	18	0	18
score>=[4,5]	0,57	0,31	0,94	0,89	0,49	8	17	1	18
score>=[5,4]	0,66	0,46	0,94	0,92	0,55	12	17	1	14
score>=[4,4]	0,68	0,50	0,94	0,93	0,57	13	17	1	13
score>=[2,5]	0,68	0,54	0,89	0,88	0,57	14	16	2	12
score>=[3,4]	0,75	0,65	0,89	0,89	0,64	17	16	2	9
score>=[4,3]	0,80	0,77	0,83	0,87	0,71	20	15	3	6
score>=[2,4]	0,84	0,85	0,83	0,88	0,79	22	15	3	4
score>=[3,3]	0,73	0,92	0,44	0,71	0,80	24	8	10	2
score>=[2,3]	0,75	0,96	0,44	0,71	0,89	25	8	10	1
score>=[3,2]	0,70	1,00	0,28	0,67	1,00	26	5	13	0
score>=[1,3]	0,68	1,00	0,22	0,65	1,00	26	4	14	0
score>=[2,2]	0,64	1,00	0,11	0,62	1,00	26	2	16	0
score>=[1,1]	0,59	1,00	0,00	0,59	NaN*	26	0	18	0

Fig. 3: Likert table: Performance values for each observer score. *NaN: Not a Number.

Conclusion

According to our results, both LI-RADS v.2014 and Likert scale show a good performance in the evaluation of liver nodules and detection of HCC. Nevertheless, a strong agreement has been shown between the LI-RADS evaluators and a moderate agreement between the Likert scale evaluators. These values were also confirmed by the Pearson correlation coefficient and suggest that the use of the LI-RADS provides a minor inter-reader difference compared to the Likert scale [5]. These assumptions prove that a further development and a wide diffusion of LI-RADS could be considered a primary purpose in order to reduce the inter-reader variability.

References

1. Forner A, Vilana R, Ayuso C et al. (2008) Diagnosis of Hepatic Nodules 20 mm or Smaller in Cirrhosis: Prospective Validation of the Noninvasive Diagnostic Criteria for Hepatocellular Carcinoma; Hepatology. 2008 Jan;47(1):97-104. Erratum in: Hepatology. 2008 Feb;47(2):769. doi: 10.1002/hep.21966.

2. Cruite I, Tang A, Sirlin CB (2013) Imaging-Based Diagnostic Systems for Hepatocellular Carcinoma; AJR Am J Roentgenol. 2013 Jul;201(1):41-55. doi: 10.2214/AJR.13.10570

3. Likert R. (1932) A technique for the measurement of attitudes; ArchPsychol 1932;22(140):1-55.

4. Villers A, Puech P, Mouton D, Leroy X, Ballereau C, Lemaitre L. (2006) Dynamic contrast enhanced, pelvic phased array magnetic resonance imaging of localized prostate cancer for predicting tumor volume: correlation with radical prostatectomy findings; J Urol 2006;176 (6 pt 1):2432-2437 doi: 10.1016/j.juro.2006.08.007

5. Barth BK, Donati OF, Fischer MA et al. (2016) Reliability, Validity, and Reader Acceptance of LI-RADS-An In-depth Analysis; Acad Radiol. 2016 Sep;23(9):1145-53. doi: 10.1016/j.acra.2016.03.014