2010年度

论文集

临安市人民医院

2010
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SCI 收录证明

根据委托人夏栋、沈海平的要求，对有关 “Xia D,Jing JY,Shen HP,Wu JJ.Value of diffusion-weighted magnetic resonance images for discrimination of focal benign and malignant hepatic lesions:a meta-analysis.J Magn Reson Imaging.2010,32(1):130-7”这一文献进行 SCI 收录情况查证。

经查阅：Web of Science（SCI-E/SSCI/A&HCI）（1900－2010.7.31），该文献被 SCI 收录。该期刊 2009 年公布的 SCI 影响因子为 2.658。

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Value of Diffusion-Weighted Magnetic Resonance Images for Discrimination of Focal Benign and Malignant Hepatic Lesions: A Meta-Analysis

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打印 电子邮件 添加到标记结果列表 保存到 EndNote Web 保存到 EndNote, RefMan, ProCite 更多选项

作者: Xia D (Xia, Dong)[1], Jing JY (Jing, Jiyong)[2], Shen HP (Shen, Haiping)[1], Wu JJ (Wu, Jianjun)[2]

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摘要: Purpose: To evaluate the ability of DW-MRI in differentiating malignant hepatic tumors from benign lesions.

Materials and Methods: Meta-analysis of 14 diagnostic studies was used. A systematic search in Medline, Embase, Web of Science (from January 1966, to October, 2009), and Cochrane Controlled Clinical Trials Register Database (through third Quarter 2009) was used with screening of the literature.

Results: A meta-analysis of all 95 published studies was performed. Fourteen studies fulfilled the inclusion criteria (804 patients with 1665 hepatic lesions). The global sensitivity was 0.91 (95% confidence interval [CI], 0.86-0.94), the specificity was 0.93 (95% CI, 0.86-0.97), the positive likelihood ratio (PLR) was 13.10 (95% CI, 6.30-27.26), the negative likelihood ratio (NLR) was 0.10 (95% CI, 0.06-0.15), and the diagnostic odds ratio (DOR) was 133.76 (95% CI, 49.77-359.45). The area under the curve of the summary receiver operator characteristic (SROC) was 0.96 (95% CI 0.94-0.98).

Conclusion: Diffusion-weighted magnetic resonance imaging is potential technically feasible to differentiate malignant from benign focal liver lesions. Apparent diffusion coefficient measurements can be useful in providing rapid quantifiable information.

文献类型: Article

语言: English

作者关键词: diffusion-weighted magnetic resonance imaging; malignant hepatic lesions; sensitivity and specificity; meta-analysis

KeyWords Plus: GRAPHICAL TEST; HEPATOCELLULAR-CARCINOMA; LIVER-LESIONS; PUBLICATION BIAS; FUNNEL-PLOT; B-VALUE; SENSITIVITY; ECHOPLANAR; MASSES; HETEROGENEITY

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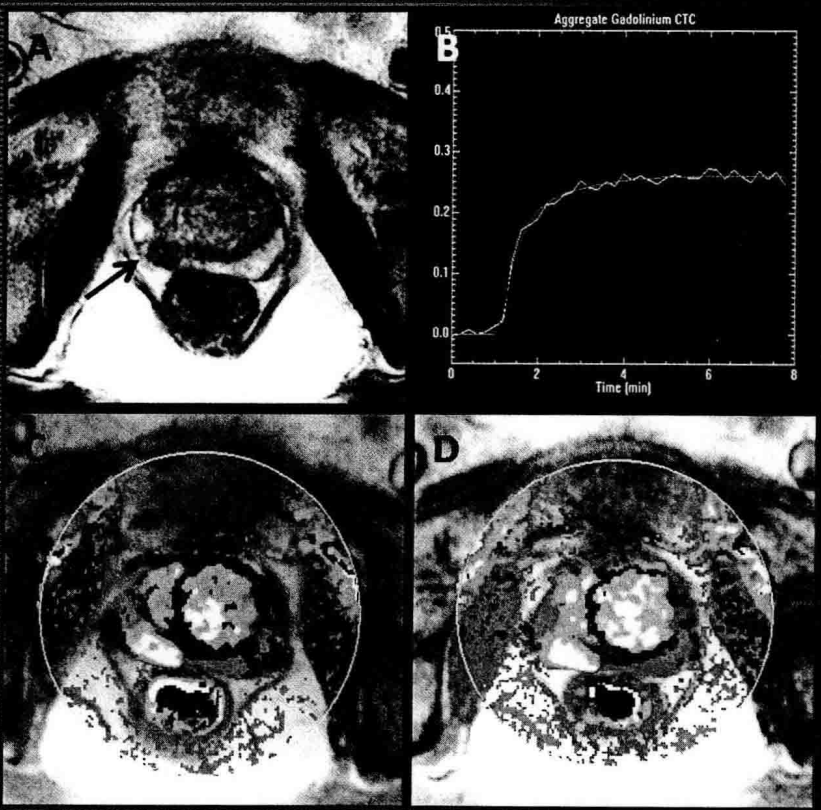

QUANTITATIVE DYNAMIC AND INTRINSIC SUSCEPTIBILITY-WEIGHTED MRI PARAMETERS IN MALIGNANT HUMAN PROSTATE from the article by Alonzi et al (pp 155–164)

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Original Research

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Dong Xia, BS,[1] Jiyong Jing, MD,[2] Haiping Shen, MS,[1]* and Jianjun Wu, MD[2]

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Materials and Methods: Meta-analysis of 14 diagnostic studies was used. A systematic search in Medline, Embase, Web of Science (from January, 1966, to October, 2009), and Cochrane Controlled Clinical Trials Register Database (through third Quarter 2009) was used with screening of the literature.

Results: A meta-analysis of all 95 published studies was performed. Fourteen studies fulfilled the inclusion criteria (804 patients with 1665 hepatic lesions). The global sensitivity was 0.91 (95% confidence interval [CI], 0.86–0.94), the specificity was 0.93 (95% CI, 0.86–0.97), the positive likelihood ratio (PLR) was 13.10 (95% CI, 6.30–27.26), the negative likelihood ratio (NLR) was 0.10 (95% CI, 0.06–0.15), and the diagnostic odds ratio (DOR) was 133.76 (95% CI, 49.77–359.45). The area under the curve of the summary receiver operator characteristic (SROC) was 0.96 (95% CI 0.94–0.98).

Conclusion: Diffusion-weighted magnetic resonance imaging is potential technically feasible to differentiate malignant from benign focal liver lesions. Apparent diffusion coefficient measurements can be useful in providing rapid quantifiable information.

Key Words: diffusion-weighted magnetic resonance imaging; malignant hepatic lesions; sensitivity and specificity; meta-analysis

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EARLY AND ACCURATE detection and characterization of focal liver lesions are important for treatment planning for patients with liver malignant neoplasms such as hepatocellular carcinoma (HCC), metastases, high-grade dysplastic nodules (HDN), and cholangiocarcinomas (CC) (1). The tumor size, number of lesions, and intrahepatic metastases are not only as important negative prognostic factors but can affect therapy (1,2).

Magnetic resonance imaging (MRI) currently yields the highest accuracy for detection of HCC but has not improved the early detection of small HCC all that much compared to computed tomography (CT) or ultrasound (3). Diffusion is the random, thermally induced movement of water molecules in biologic tissues, called Brownian motion (4). Diffusion-weighted (DW) magnetic resonance imaging (MRI) is sensitive to molecular diffusion and allows for tissue characterization by probing tissue microstructural changes, quantified as the apparent diffusion coefficient (ADC) (5). DW images has been reported to be useful for differentiating malignant and benign lesions and for characterization of malignant and benign lesions through quantification of ADC (6–9).

We performed the present meta-analysis to assess the diagnostic use of DW-MRI and to establish the overall accuracy of DW-MRI measurement for characterization of malignant hepatic lesions.

MATERIALS AND METHODS

Search Strategy and Study Selection

We searched the following electronic databases: Medline, Embase, Web of Science (from January, 1966, to October, 2009), and Cochrane Controlled Clinical Trials Register Database (through third Quarter 2009) for all studies examining the diagnostic accuracy of DW-MRI for detection of malignant hepatic lesions. For the electronic search we used the following terms or MeSH subject headings: "Diffusion Magnetic Resonance Imaging," "Diffusion-weighted magnetic resonance images," "DW-MRI," "DW magnetic resonance images"; "Carcinoma, Hepatocellular," "Hepatocellular Carcinoma," "liver cancer"; "metastases," "cholangiocarcinomas" and liver; and "diagnosis," "sensitivity," "specificity," "predictive value," "likelihood ratio," "false positive," "false negative," and "review," "meta-analysis."

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We contacted the authors for further study details if needed and searched the reference lists from primary and review articles. No language restriction was used, and all foreign-language publications were translated. Further searches were performed by manually reviewing abstract booklets, conference proceedings, and review articles.

We included all studies that met the following criteria: assessing the diagnostic accuracy of DW-MRI for malignant hepatic lesions; providing both sensitivity (true-positive rate) and specificity (true-negative rate) of DW-MRI for the diagnosis of malignant hepatic lesions; providing sufficient information to construct the 2 × 2 contingency table for individual study subjects; and stating a test method for DW-MRI in the methods. We excluded conference abstracts, abstracts, and letters because of limited information. Two reviewers independently judged study eligibility while screening the citations. Disagreements were resolved by consensus.

Data Extraction

The final set of articles was assessed independently by two reviewers. The reviewers independently abstracted data from each study to obtain information on the year of publication, country of origin, number of patients, types of malignant, types of benign control, confirmation of liver lesions, DW-MRI test methods, diagnostic cutoff points, number of lesions, sensitivity and specificity of the data, and methodological quality. Each reviewer extracted the data to construct a 2 × 2 table. Any disagreements were resolved by consensus.

Quality Assessment

The methodological quality of each study was assessed using a checklist based on criteria adapted from the Cochrane Collaboration guidelines (10,11) and the quality assessment for studies of diagnostic accuracy (QUADAS) tool (maximum score, 14) (12).

Statistical Analysis

We used standard methods recommended for meta-analyses of diagnostic test evaluations (10,11). For each study the sensitivity, specificity, positive and negative likelihood ratios, and a diagnostic odds ratio (DOR) were calculated. The DOR is the ratio of the odds of a positive result in malignant hepatic lesions compared with benign hepatic lesions: [sensitivity/(1-sensitivity)]/[(1-specificity)/specificity]. Each study was weighted using an inverse variance method. We constructed summary receiver operator characteristic (SROC) curves to summarize the study results. A smoothed curve was then fitted across the studies to represent the relationship between sensitivity and the proportion of false positives (1-specificity). The sensitivity and specificity for the single test threshold identified for each study were used to plot an SROC curve. Pooling of the summary indices was performed using the bivariate mixed-effects binary regression model (13).

To detect heterogeneity, the likelihood ratios and DORs were graphically displayed using forest plots and analyzed using Cochran's Q test. A *P*-value of less than 0.05 by Cochran's Q test indicated significant heterogeneity. To quantify the extent of heterogeneity the I^2 statistic was used to measure the percentage of variability among summary indices that were caused by heterogeneity rather than chance. A study with an I^2 greater than 50% indicated substantial heterogeneity.

To explore sources of heterogeneity among studies, univariate meta-regression analysis (inverse variance weighted) was used. The covariates included spectrum characteristics (eg, study setting, prevalence, type of bacterial infection), quality of the study (QUADAS scores), and methodological features (eg, sample size).

Publication bias was examined visually by inspecting funnel plots and statistically by using Egger's regression model (14). If publication bias was present, the effect of such a bias on the final summary estimate was assessed using the trim and fill method (15). This method imputes the missing studies and recalculates a new summary estimate. The difference between the calculated and observed values was then used to determine the effect of bias on the diagnostic performance of the test. Analyses were performed using Stata (v. 10.0; StataCorp, College Station, TX).

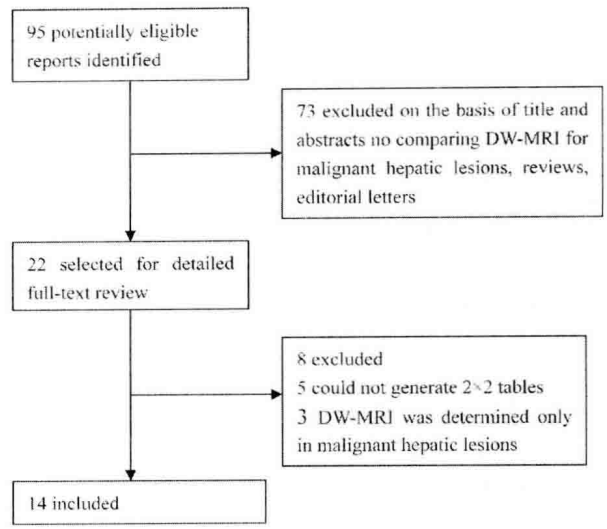

Figure 1. Study identification, inclusion, and exclusion for meta-analysis.

RESULTS

We retrieved 95 potentially eligible reports and 22 publications dealing with DW-MRI for the diagnosis of malignant hepatic lesions considered as potentially suitable for inclusion in the analysis. After full-text review, eight studies were excluded (Fig. 1). In total, 14 studies (8,9,16–27) including 804 patients with 1665 hepatic lesions were available for the final analysis. The trials identified were from Japan, France, Netherlands, Germany, Turkey, Greece, UK, Belgium, and the United States. All studies included in the analysis used 1.5 T scanner systems. The b-values of

Table 1
Summary of Included Studies

Study year	Country	Study design	Patients, No.	Types of malignant	Types of benign control	Confirmation of liver lesions	Diffusion-weighted MRI method	Sensitivity encoding (SENSE)	Cutoff (ADC × 10^3 mm /s^2)	Lesions, No.	TP	FP	FN	TN	Sens. %	Speci. %	Quality Score
Ichikawa et al, Ref. 9	Japan	CR	46	HCC, metastases ID:0.7–10 cm	Hemangiomas	Surgical specimens, biopsy, follow-up imaging	1.5-T system, Single shot echo planar DW-MRI, b-values (1.6,16, and 55 s/mm^2)	NO	5.5	74	59	0	4	11			8
Kim et al, Ref. 16	Japan	CR	70	HCC, metastases, CC ID:0.7–10 cm	Hemangiomas, cysts, angiomyolipoma ID:0.8–7 cm	Surgical specimens, biopsy, follow-up imaging	1.5 T system, Single shot echo-planar DW-MRI, b-values (3, 57,192, 408,517,705 and 846 s/mm^2)	NO	1.6 (b = 850)	79	48	6	1	24			8
Taouli et al, Ref. 8	France	CR	43	HCC, metastases ID: 1–8.7 cm	Hemangiomas, cysts, adenoma ID:2–15.5 cm	Surgical specimens, biopsy, follow-up imaging	1.5-T system, two breath-hold DW-MRI, b-values (0,134, 267,400, and 500 s/mm^2),	NO	1.5	52	21	3	4	24	84	89	11
Nasu et al, Ref. 17	Japan	CR	62	Metastases ID:0.5–6 cm	Nodules, cysts	Surgical resection, follow-up imaging	1.5 T system, DW SENSE MRI, b-values (0, and 500 s/mm^2)	YES	NA	95	33	4	7	51			9
Coenegrachts et al, Ref. 18	Netherlands	CR	24	Metastases ID:0.4–2.6 cm	Hemangiomas, cysts ID:0.3–7.2 cm	Surgical resection	1.5-T system, breath-hold DW-MRI, b values (b50, b520, b5300, b5800 s/ mm^2)	YES	NA	129	40	0	0	89	100	100	10
Bruegel et al, Ref. 19	Germany	CR	52	Metastases ID:0.3–8.4 cm	Hemangiomas, cysts ID:0.3–4.8 cm	surgical specimens, biopsy, follow-up imaging	1.5-T system, breath-hold DW-MRI, b-values (50, 300, and 600 s/mm^2)	YES	NA	224	106	8	12	98			11
Bruegel et al, Ref. 20	Germany	CR	102	HCC, metastases	FNH, hemangiomas, cysts	surgical specimens, biopsy	1.5-T system, breath-hold DW-MRI, b-values (50, 300, and 600 s/mm^2)	NO	1.63	204	84	16	9	95			12
Erturk et al, Ref. 21	Turkey	CR	78	HCC, metastases ID:1–4.2 cm	Hemangiomas, cysts ID:1.4–4.8 cm	Biopsy, follow-up imaging	1.5 T system, breath-hold DW SENSE MRI, b-values (400 and 1,000 s/mm^2)	YES	1.63	86	40	2	4	40			11
Goshima et al, Ref. 22	Japan	CR	37	HCC, metastases	Hemangiomas, cysts	Surgical specimens, biopsy, follow-up imaging	1.5 T system, breath-hold DWI, b-values (100, 200, 400, and 800 s/mm^2)	NO	NA	55	26	9	2	18			9
Gourtsoyianni et al, Ref. 23	Greece	CR	27	HCC, metastases	Hemangiomas, cysts	MRI, clinical follow-up	1.5-T system, Single shot echo planar DW-MRI, b-values (0, 50, 500 and 1,000 s/mm^2)	NO	1.47	37	15	0	0	22	100	100	8
Koh et al, Ref. 24	UK	CR	38	Metastases ID:0.5–9.5 cm	Hemangiomas, cysts ID:0.5–9.5 cm	Pathology, follow-up MRI	1.5-T system, DW-MRI, b-values (0,150 and 500 s/mm^2)	YES	NA	133	65	2	18	48			9
Parikh et al, Ref. 25	USA	CR	53	HCC, metastases ID:1–15.1 cm	Hemangiomas, cysts, abscess, adenomas, FNH, intrahepatic hematoma	Follow-up imaging, clinical follow-up, surgical specimens	1.5 T system, breath-hold DW SENSE MRI, b-values (0, and 50 s/mm^2)	YES	1.6	211	101	17	35	58			12
Vossen et al, Ref. 26	USA	CR	117	HCC, metastases ID:1–17.8 cm	Hemangiomas, FNH ID:1–17.8 cm	Biopsy, follow-up MRI	1.5 T system, breath-hold DWI, b value, 500 s/mm^2	YES	2.3	172	122	0	17	43			10
Vandecaveye et al, Ref. 27	Belgium	CR	55	HCC, HDN, CC ID:0.7–14 cm	RN, LDN, FNH, inflammatory pseudo-tumour ID:0.7–14 cm	Surgical specimens	1.5-T system, Single shot echo planar DW-MRI, b-values (b = 0,100, 600, 1,000 s/mm^2)	NO	NA	114	59	9	3	43	95.2	82.7	12

TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; HCC, hepatocellular carcinoma; CC, cholangiocarcinomas; HDN, high-grade dysplastic nodules; FNH, focal nodular hyperplasia; RN, regenerative nodules; LDN, low-grade dysplastic nodules; ADC, apparent diffusion coefficients; NA, not available.

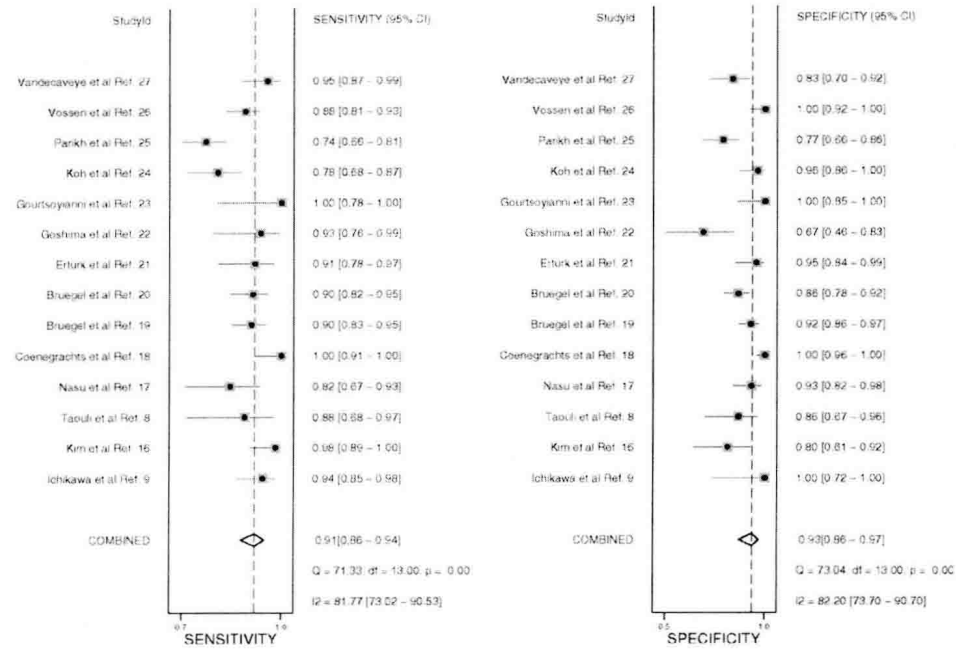

Figure 2. Forest plot of the sensitivity and specificity of DW-MRI in the diagnosis of malignant hepatic lesions with corresponding heterogeneity statistics. Pooled estimates for the DW-MRI were as follows: sensitivity, 0.91 (95% CI, 0.86–0.94); specificity, 0.93 (95% CI, 0.86–0.97).

the DW-MRI sequence varied between different studies. Of these studies, seven studies used the sensitivity encoding (SENSE) technique. The size of lesions ranged from 0.3–17.8 cm. Of these 1665 hepatic lesions, 943 hepatic lesions were malignant; malignant hepatic lesions included hepatocellular carcinomas, liver metastases, cholangiocarcinomas, and high-grade dysplastic nodules. There were 741 benign hepatic lesions including hemangiomas, cysts, abscess, adenomas, focal nodular hyperplasia, intrahepatic hematoma, and low-grade dysplastic nodules. In five studies benign lesions included solid lesions. Eight studies reported a cutoff of ADCs. The threshold ranged from 1.47–5.5 $\times$ 10^3 mm/s^2. The details of all 14 studies are shown in Table 1.

Quantitative Data Synthesis

Figure 2 shows the forest plot for the sensitivity and specificity of 14 DW-MRI used for the diagnosis of malignant hepatic lesions. The sensitivity ranged from 0.74–1.0 (mean, 0.91; 95% confidence interval [CI], 0.86–0.94), while the specificity ranged from 0.77–1.00 (mean, 0.93; 95% CI, 0.86–0.97). We also found that the positive likelihood ratio (PLR) was 13.10 (95% CI, 6.30–27.26), the negative likelihood ratio (NLR) was 0.10 (95% CI, 0.06–0.15; Fig. 3), and the DOR was 133.76 (95% CI, 49.77–359.45).

The SROC curve presents a global summary of test performance, and it shows the tradeoff between sensitivity and specificity. A graph of the SROC curve for DW-MRI showing true-positive rates vs. false-positive rates from individual studies is shown in Fig. 4. The SROC curve (Fig. 4) yielded a maximum joint sensitivity and specificity of 0.93 (95% CI, 0.86–0.97), an area under the curve of 0.96 (95% CI, 0.94–0.98), indicating a high level of overall accuracy.

Cochran's Q for sensitivity, specificity, PLR, NLR, DOR, and SROC were 71.33 ($P < 0.001$), 73.04 ($P < 0.001$), 74.67 ($P < 0.001$), 77.59 ($P < 0.001$), 230 ($P < 0.001$), and 14.13 ($P < 0.001$), respectively, and I^2 for sensitivity, specificity, PLR, NLR, and DOR was 81.77, 82.20, 74.33, 83.25, 99, and 85.85, respectively, indicating significant heterogeneity and inconsistency between studies.

Multiple Regression Analysis and Publication Bias

Study country, number of patients, spectrum characteristics, methodological features, ADC cutoff, and the quality of the study were used in the meta-regression analysis to assess the source of variability among studies. As shown in Tables 2 and 3, higher quality studies (QUADAS score, 10) produced sensitivity and specificity values that were not significantly higher than lower-quality studies. There were significant differences for sensitivity encoding (sensitivity, $P = 0.03$; specificity, $P = 0.08$) indicating that the SENSE technique may affect diagnostic accuracy. Study country, number of patients, and spectrum characteristics did not affect the diagnostic accuracy, except for the observation that the United States of America (USA) potentially affected diagnostic sensitivity ($P = 0.06$) and solid benign lesion included potentially affected diagnostic specificity ($P = 0.08$).

Publication bias was detected using Egger's regression model ($P = 0.001$). These results indicated a potential publication bias. Visual inspection of the

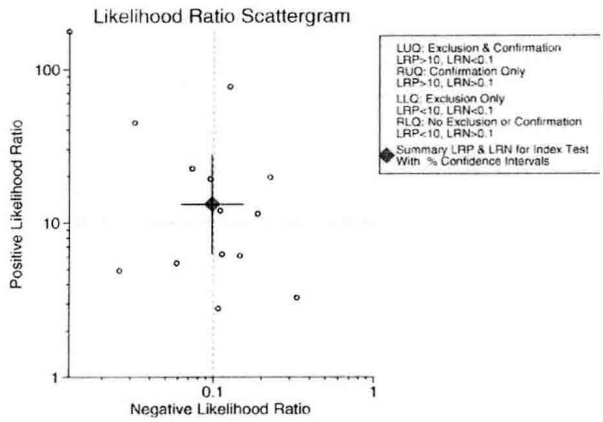

Figure 3. Scattergram of the positive likelihood ratio and negative likelihood ratio. Pooled estimates for the DW-MRI test were as follows: PLR 13.10 (95% CI, 6.30–27.26), NLR 0.10 (95% CI, 0.06–0.15).

funnel plot suggested that missing studies were likely to fall below the summary estimate. These studies were then imputed to calculate a new summary estimate (Fig. 5). The new DOR was a little lower than the observed DOR visually by inspecting funnel plots. Therefore, the existing studies could have overestimated the diagnostic performance of DW-MRI.

DISCUSSION

The present meta-analysis complied with the recommendations for reporting meta-analyses of diagnostic tests (28). This systematic review identified 14 eligible diagnostic trials that assessed the diagnostic accuracy of DW-MRI for malignant hepatic lesions. The pooled DOR of 14 studies (1665 hepatic lesions) was 133.76. Unlike the traditional ROC plot that explores the effect of varying thresholds (ie, cutpoints for determining positive tests) on sensitivity and specificity in a single study, each data point in the SROC plot represents a separate study. The SROC curve presents a global summary of test performance and shows the trade-off between sensitivity and specificity. We found the area under the SROC to be 0.96, with a lower

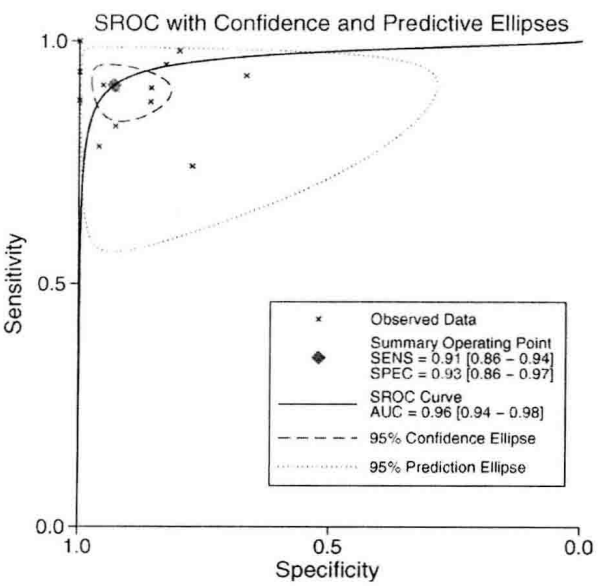

Figure 4. Summary receiver operating characteristics curve with confidence and predictive ellipses for DW-MRI test. Circles indicate 95% confidence and predictive ellipses; n = 14 studies.

Table 2
Meta-Regression of the Effects of Study Country, Number of Patients, Spectrum Characteristics, Methodological Features, ADC Cutoff, and the Quality of the Study on the Diagnostic Sensitivity of DW-MRI

Covariates	Studies, no.	Coefficient	Estimate (95% CI)	P
QUADAS≥10	8	2.26	0.91 (0.84–0.95)	0.82
Country				
Japan	4	2.55	0.93 (0.84–0.97)	0.50
Germany	2	2.24	0.90 (0.77–0.96)	0.91
USA	2	1.52	0.82 (0.67–0.91)	0.06
Patient no.	14	2.33	0.91 (0.86–0.94)	0.98
Lesions ≥100	7	2.09	0.89 (0.82–0.93)	0.30
Types of malignant				
Metastases only	4	2.12	0.89 (0.79–0.95)	0.62
Types of benign				
Solid lesion included	5	1.81	0.86 (0.69–0.94)	0.08
Sensitivity encoding DW-MRI	7	1.89	0.87 (0.81–0.91)	0.03
ADC cutoff	8	2.29	0.91 (0.84–0.95)	0.98

DW-MRI, diffusion-weighted magnetic resonance images; ADC, apparent diffusion coefficient.

Table 3
Meta-Regression of the Effects of Study Country, Number of Patients, Spectrum Characteristics, Methodological Features, ADC Cutoff, and the Quality of the Study on the Diagnostic Specificity of DW-MRI

Covariates	Studies, no.	Coefficient	Estimate (95% CI)	P
QUADAS≥10	8	2.62	0.93 (0.84–0.97)	0.92
Country				
Japan	4	1.94	0.87 (0.66–0.96)	0.27
Germany	2	2.17	0.90 (0.61–0.98)	0.60
USA	2	2.77	0.94 (0.67–0.99)	0.88
Patient no.	14	2.6	0.93 (0.86–0.97)	0.99
Lesions ≥100	7	2.74	0.94 (0.85–0.98)	0.65
Types of malignant				
Metastases only	4	3.31	0.96 (0.90–0.99)	0.10
Types of benign				
Solid lesion included	5	1.81	0.86 (0.69–0.94)	0.08
Sensitivity encoding DW-MRI	7	3.00	0.95 (0.89–0.98)	0.08
ADC cutoff	8	0.07	0.93 (0.83–0.98)	0.94

DW-MRI, diffusion-weighted magnetic resonance images; ADC, apparent diffusion coefficient.

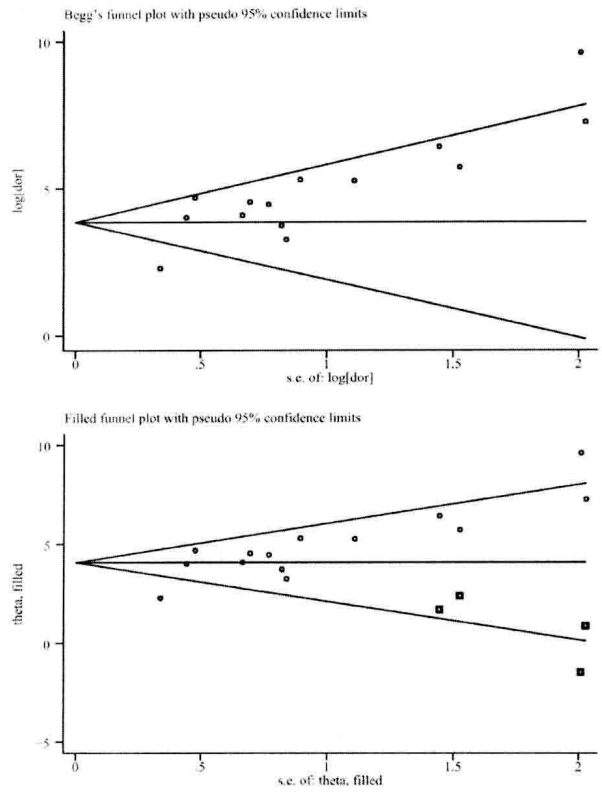

Figure 5. Funnel graph for the assessment of potential publication bias in DW-MRI test. The funnel graph plots the log of the diagnostic odds ratio (DOR) against the standard error (SE) of the log of the DOR. A indicates the observed summary estimate. B indicates the new summary estimate if all imputed studies were included.

limit 95% CI of 0.94. The results of this systematic review and meta-analysis indicated that DW-MRI could be used as a helpful diagnostic criterion for malignant hepatic lesions. Figure 6 shows that using a DW-MRI test would raise the posttest probability to 81% when pretest positive from 25% with a PLR of 13 and would reduce the posttest probability as low as 3% when negative with a NLR of 0.1. This indicates that using DW-MRI was helpful for increasing accuracy for detection of the malignant hepatic lesions. It was suggested that ADC was useful in the characterization of focal hepatic lesions. However, we found the threshold value of ADCs had a large variability depending on the studies. Taouli et al (8) found that the ADCs varied by b-values. In our meta-analysis the b-values of included studies also varied.

An exploration of the reasons for heterogeneity rather than the computation of a single summary measure is an important goal of meta-analysis (29). We found significant heterogeneity with regard to sensitivity, specificity, PLR, NLR, DOR, and SROC among the studies analyzed. Our meta-analysis suggested that the SENSE technique may affect diagnostic accuracy. A possible explanation is that in parallel imaging techniques such as SENSE the quality of DW images of the hepatic lesions has markedly improved through the improvement of the signal-to-noise ratio (30,31). Although the tests did not reach significance in specificity (0.08), solid benign lesion included potentially affected diagnostic specificity. A possible explanation is that DC values of benign solid lesions such as focal nodular hyperplasia and adenoma were similar to those of hepatocellular cancer and metastases (32). This indicated that the diagnostic accuracy of DW-MRI test were underpowered when benign control including solid lesions.

Publication bias is common in diagnostic studies, possibly more so than in studies of randomized controlled trials (33). We detected publication bias in our review. As expected, the missing studies fell below the summary estimate. With imputed values, the recalculated DOR was only a little lower, but it was still close to the observed value, which indicates the true diagnostic performance of DW-MRI. However, the statistical methods used to assess publication bias have limitations (34–37). Therefore, the above findings must be interpreted in this context.

Our meta-analysis had several limitations. First, the exclusion of conference abstracts and letters to the editors may have led to the publication bias that

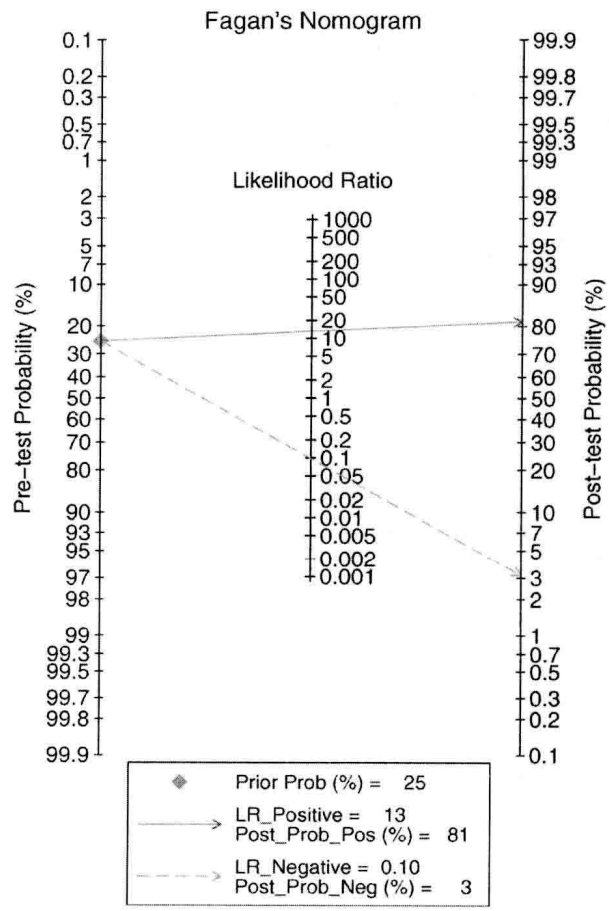

Figure 6. Fagan plot of the probability for DW-MRI test in the diagnosis of malignant hepatic lesions, prior probability (0.25).