

第五版 BI-RADS 对乳腺 X 线可疑钙化评估分类的临床应用

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摘 要:【目的】探讨第五版乳腺影像报告与数据系统(BI-RADS)对可疑钙化评估分类的临床应用价值。【方法】回顾性分析2012年5月至2017年5月乳腺X线检出可疑钙化并切除活检患者的乳腺X线片。依据第五版BI-RADS X线术语词典,分析可疑钙化的形态(不定形,粗糙不均质,细小多形性及线样或线样分枝)和分布(弥漫、区域、成簇、线样及叶段)。以病理学金标准,计算钙化形态、分布及组合分类的阳性预测值(PPV),将其与第五版BI-RADS各分类的PPV范围进行比较。【结果】共170例纳入研究,116例为良性,54例为恶性,PPV为31.8%(54/170)。钙化形态方面,不定形、粗糙不均质、细小多形性钙化为4B类(10%<PPV≤50%),线样或线样分枝钙化为5类(PPV≥95%),与第五版BI-RADS建议的形态分类基本一致。综合考虑钙化的形态和分布后,弥漫分布的不定形及细小多形钙化、区域分布的粗糙不均质及细小多形钙化均可降为2类(PPV=0%),不需组织活检;区域、成簇、线样及叶段分布的不定形钙化,成簇、线样及叶段分布的粗糙不均质钙化和成簇分布的细小多形钙化为4B类(10%<PPV≤50%)。线样及叶段分布的细小多形性钙化为4C类(50%<PPV<95%),线样及叶段分布的线样或线样分枝钙化为5类(PPV≥95%)。【结论】第五版BI-RADS对可疑钙化形态分类的建议具有良好的临床应用价值,钙化准确的BI-RADS分类仍需综合考虑钙化的形态和分布。

关键词:乳腺X线;钙化;乳腺影像报告与数据系统;阳性预测值

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Clinical Application of BI-RADS (5th Ed) Mammography Lexicon in the Category of Suspicious Calcification

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Abstract: 【Objective】 To explore the clinical application of the fifth edition of BI-RADS for the category of suspicious calcification. 【Methods】 Mammograms of patients with suspicious calcification from May 2012 to May 2017 were reviewed retrospectively. The morphology (amorphous, coarse heterogeneous, fine pleomorphic, fine linear or fine linear branching) and distribution (diffuse, regional, grouped, linear, segmental) of suspected calcification according to the fifth edition of the BI-RADS were analyzed. Taking pathology as the gold standard, the positive predictive value (PPV) of morphology, distribution and combination of morphology and distribution was calculated and compared with the PPV range of the fifth edition of BI-RADS. 【Results】 A total of 170 patients were included in the study, 116 were benign, 54 were malignant, and PPV was 31.8% (54/170). In terms of morphology, amorphous, coarse heterogeneous, fine pleomorphic calcification were category 4B (10% <PPV ≤50%), fine linear or fine linear branching calcification was category 5 (PPV ≥ 95%). It was basically consistent with the morphological category recommended by the fifth edition of

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BI-RADS. After comprehensive consideration of the morphology and distribution, diffuse distribution of amorphous and fine pleomorphic calcification, regional distribution of coarse heterogeneous and fine pleomorphic calcification can be reduced to category 2 (PPV=0%), which did not require tissue biopsy. Amorphous calcification of regional, grouped, linear and segmental, coarse heterogeneous calcification of grouped, linear and segmental and fine pleomorphic calcifications of grouped were category 4B (10%<PPV≤50%). The fine pleomorphic calcifications of linear and segmental distribution was category 4C (50%<PPV<95%), fine linear or fine linear branching calcification of linear and segmental were category 5 (PPV≥95%). 【Conclusions】 The fifth edition of BI-RADS has a good clinical application value for the category of suspicious calcification morphology. For the accurate BI-RADS category, it is in demand to consider the morphology and distribution of calcification.

Key words: mammography; calcification; BI-RADS; positive predictive value

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乳腺X线对钙化的检出具有较高敏感性,但是其阳性预测值较低,仅12.3%~42.0%的钙化被病理诊断为恶性^[1-5]。目前,乳腺影像报告与数据系统(Breast Imaging Reporting and Data System, BI-RADS)已经成为乳腺影像诊断领域的经典工具书籍,为乳腺钙化的诊断和鉴别诊断提供了有效的指导。BI-RADS是由美国放射学院(American College of Radiology, ACR)于1993年出版,其规范了乳腺X线摄影术语,评估分类,影像数据收集和报告,分别于1995年、1998年、2003年经历3次修订^[6]。第四版(2003年)BI-RADS沿用10年后,ACR在总结乳腺影像技术发展和临床实践经验的基础上,于2013年出版了第五版BI-RADS(现为最新版)。BI-RADS建议对病变给予最终BI-RADS分类,这些分类代表着不同的恶性程度和临床处理建议,但是第四版对于不同形态钙化的BI-RADS分类未给出明确建议,仅依据钙化形态将可疑钙化分为两类,分别为中间性钙化(不定形钙化和粗糙不均质钙化)和高度恶性可能钙化(细小多形性钙化和线样或线样分枝钙化)^[7]。据文献报道,不定形钙化、粗糙不均质钙化、细小多形性钙化及线样或线样分枝钙化的阳性预测值(positive predictive value, PPV)分别为21%、13%、29%及70%^[1-4]。据此,第五版BI-RADS建议不定形钙化,粗糙不均质钙化及细小多形性钙化为4B类(10%<PPV≤50%),线样或线样分枝钙化为4C类(50%<PPV<95%)^[8]。至此,第五版BI-RADS把乳腺钙化形态征象和BI-RADS分类直接联系,为临床提供了较为明确的处理指导。Kim等^[9]报道了第五版BI-RADS对形

态可疑钙化评估分类的临床应用,发现不定形钙化为4A类(2%<PPV≤10%)、粗糙不均质钙化为4B类(10%<PPV≤50%)、细小多形性钙化为4C类(50%<PPV<95%),线样或线样分枝钙化为5类(PPV≥95%),与第五版BI-RADS建议不一致。除了形态,钙化分布亦有助于钙化的诊断^[1,3-4,9]。本研究通过回顾性分析乳腺可疑钙化的形态和分布,探讨第五版BI-RADS对可疑钙化评估分类的临床应用价值。

1 材料与方法

1.1 病例资料

回顾性分析本中心2012年5月至2017年5月乳腺X线检查检出可疑钙化并切除活检的患者558例。排除X线钙化区域临床触及肿块的患者305例,X线检查前行组织活检患者83例,共170例患者纳入本研究。患者均为女性,年龄28~76岁,平均46(S=8)岁。

1.2 乳腺X线检查方法及图像分析

乳腺X线检查采用数字乳腺X线设备(芬兰,普兰梅德),由具有5年以上X线检查经验的技师分别拍摄双乳头尾位和内外斜位。依据第五版BI-RADS X线术语词典,由2名具有5年以上工作经验的乳腺影像诊断医师在未知病理结果的情况下共同阅片分析可疑钙化的形态和分布,若两名医师阅片结论不一致,则邀请上级医师参与讨论,并达成一致。钙化形态分为不定形、粗糙不均质、细小多形性及线样或线样分枝,分布分为弥漫、区域、成簇、线样及叶段。第五版BI-RADS评估分

表1 BI-RADS评估分类及相应处理意见
Table 1 BI-RADS assessment categories and management

Assessment	Management	Likelihood of cancer
Category 0: incomplete—Need additional imaging evaluation and/or prior mammograms for comparison	Recall for additional imaging and/or comparison with prior examinations	NA
Category 1: negative	Routine mammography screening	Essentially 0% likelihood of malignancy
Category 2: benign	Routine mammography screening	Essentially 0% likelihood of malignancy
Category 3: probably benign	Short-interval (6-month) follow-up or continued surveillance mammography	>0 but $\leq 2\%$ likelihood of malignancy
Category 4: Suspicious	Tissue diagnosis	>2% but <95% likelihood of malignancy
Category 4A: low suspicion for malignancy		>2% to $\leq 10\%$ likelihood of malignancy
Category 4B: moderate suspicion for malignancy		>10% to $\leq 50\%$ likelihood of malignancy
Category 4C: high suspicion for malignancy		>50% to <95% likelihood of malignancy
Category 5: Highly suggestive of malignancy	Tissue diagnosis	$\geq 95\%$ likelihood of malignancy
Category 6: Known biopsy-proven malignancy	Surgical excision when clinically appropriate	NA

NA: not applicable

类见表1^[8]。

1.3 钙化的活检方法

乳腺X线检出的可疑钙化均行X线引导下的导丝定位,并切除活检,切除标本术中行X线摄影以确保钙化的切除。以病理结果为金标准,对病理诊断为良性的患者建议至少12个月随访观察。

1.4 统计学方法

计算钙化形态、分布及组合分类的PPV,各分类的PPV=病理诊断为乳腺癌病例数/活检病例数(即总病例数),将其与第五版BI-RADS各分类的PPV范围进行比较。

2 结果

2.1 病理结果

170例患者中,病理为良性者116例,恶性者54例,PPV为31.8%。患者病理类型见表2。

2.2 钙化的PPV

可疑钙化各形态及分布的PPV见表3。在钙化形态方面,不定形、粗糙不均质、细小多形性及

线样或线样分枝钙化的PPV分别为16%、20%、47%及100%。依据BI-RADS分类标准,不定形,粗糙不均质,细小多形性钙化为4B类($10\% < PPV \leq 50\%$),线样或线样分枝钙化为5类($PPV \geq 95\%$)。在钙化分布方面,弥漫、区域、成簇、线样及叶段钙化的PPV分别为0%、12%、23%、60%及76%。

可疑钙化形态及分布组合的PPV见表4。弥漫分布的不定形及细小多形钙化、区域分布的粗糙不均质及细小多形钙化均可降为2类($PPV = 0\%$),不需组织活检。区域、成簇、线样及叶段分布的不定形钙化,成簇、线样及叶段分布的粗糙不均质钙化和成簇分布的细小多形钙化为4B类($10\% < PPV \leq 50\%$)。线样及叶段分布的细小多形性钙化为4C类($50\% < PPV < 95\%$)、线样及叶段分布的线样或线样分枝钙化为5类($PPV \geq 95\%$)。

2.3 与既往研究钙化的PPV比较

结合钙化的形态和分布,本研究PPV与既往研究钙化的PPV对比见表5。既往研究显示弥漫分布的不定形、粗糙不均质及线样或线样分枝钙化,区域分布的细小多形和线样或线样分枝钙化

表2 乳腺X线检出可疑钙化的病理结果

Table 2 Pathological results of suspicious calcifications detected by mammography

Pathological results	Patients (n)	Percent /%
Malignant	54	31.8
IDC	20	37.0
DCIS	33	61.1
ILC	1	1.9
Benign	116	68.2
Fibrocystic change	89	76.7
Adenosis	21	18.1
Fibroadenoma	4	3.5
Papilloma	2	1.7

IDC: invasive ductal carcinoma, DCIS: ductal carcinoma in situ, ILC: invasive lobular carcinoma.

表3 形态和分布的阳性预测值

Table 3 Positive predictive value (PPV) according to the morphology and distribution descriptors

Descriptor	Benign	Malignant	Total	PPV [% (n/N)]
Morphology				
Amorphous	72	14	86	16(14/86)
Coarse heterogeneous	8	2	10	20(2/10)
Fine pleomorphic	36	32	68	47(32/68)
Fine linear or fine linear branching	0	6	6	100(6/6)
Distribution				
Diffuse	4	0	4	0(0/4)
Regional	42	6	48	12(6/48)
Grouped	57	17	74	23(17/74)
Linear	6	9	15	60(9/15)
Segmental	7	22	29	76(22/29)
Total	116	54	170	31.8(54/170)

可降为2类(PPV=0%),不需组织活检。区域、成簇、线样及叶段分布的不定形和粗糙不均质钙化,成簇分布的细小多形钙化为4B类(10%<PPV≤50%)。成簇、线样及叶段分布的线样或线样分枝钙化和线样及叶段分布的细小多形钙化为4C类(50%<PPV<95%)。对比既往研究,本研究区域分布的粗糙不均质钙化为2类(PPV=0%),低于以往研究的4B类(PPV=20%);线样及叶段分布的线样

或线样分枝钙化为5类(PPV=100%),高于以往研究的4C类(PPV=86%)。

3 讨论

既往研究证实ACR BI-RADS评估分类有助于乳腺病变的恶性风险分层,并为临床管理提供有效的指导^[1, 10-13]。依据钙化形态,第五版

表4 形态和分布组合的阳性预测值

Table 4 Positive predictive value (PPV) according to the combination of morphology and distribution descriptors

Combination of descriptor	Benign	Malignant	Total	PPV [% (n/N)]
Amorphous				
Diffuse	3	0	3	0(0/3)
Regional	25	6	31	19(6/31)
Grouped	36	6	42	14(6/42)
Linear/ Segmental	8	2	10	20(2/10)
Coarse heterogeneous				
Diffuse	NA	NA	NA	NA
Regional	2	0	2	0(0/2)
Grouped	5	1	6	17(1/6)
Linear/ Segmental	1	1	2	50(1/2)
Fine pleomorphic				
Diffuse	1	0	1	0(0/1)
Regional	15	0	15	0(0/15)
Grouped	16	10	26	38(10/26)
Linear/ Segmental	4	22	26	85(22/26)
Fine linear or fine linear branching				
Diffuse	NA	NA	NA	NA
Regional	NA	NA	NA	NA
Grouped	NA	NA	NA	NA
Linear/ Segmental	0	6	6	100(6/6)
Total	116	54	170	31.8(54/170)

NA: not applicable

BI-RADS将钙化分为两类:不定形、粗糙不均质及细小多形性钙化为4B类,线样或线样分枝钙化为4C类^[8]。尽管4类均需行组织活检,但是4B类PPV小于50%,提示病变良性可能大于恶性,而4C类PPV大于50%,提示恶性可能大于良性。本研究显示,不定形、粗糙不均质、细小多形性及线样或线样分枝钙化的PPV分别为16.3%、20.0%、47.1%及100%。依据BI-RADS分类标准,本研究的不定形、粗糙不均质、细小多形性钙化评估为4B类,与BI-RADS一致;线样或线样分枝钙化评估为5类,高于BI-RADS建议的4C类(PPV=70%)^[1-4,8]。Kim等^[9]依据第五版BI-RADS总结显示线样或线样分枝钙化亦为5类(PPV=100%)。笔者分析原因,认为既往研究的线样或线样分枝钙化例数分别为32例、19例、23例或12例^[1,3-5],

均大于本研究的6例或Kim等研究的8例,不同研究钙化形态分布的不均造成了PPV的差异。然而4C类和5类PPV均大于50%,提示病变恶性可能大于良性,依据BI-RADS处理意见,两种分类均需要组织活检。综上所述,第五版BI-RADS对可疑钙化形态分类的建议具有良好的临床应用价值,为临床医生提供了准确的处理意见。

在钙化分布方面,第五版BI-RADS未对各分布的分类提出明确建议。但是研究显示分布有助于钙化良恶性的鉴别诊断^[1,3-4,9]。第五版BI-RADS总结以往研究显示弥漫钙化为2类(PPV=0%)、区域及成簇分布钙化为4B类(PPV=26%、PPV=31%)、线样及叶段分布钙化为4C类(PPV=60%、PPV=62%)^[8]。Kim等^[9]研究显示弥漫分布钙化为2类(PPV=0%)、区域分布钙化为4A类

表5 既往研究钙化形态及分布组合的阳性预测值

Table 5 Positive predictive value (PPV) according to the combination of morphology and distribution descriptors from previous studies [% (n/N)]

Descriptor	Liberman ^[1]	Berg ^[2]	Burnside ^[3]	Bent ^[4]	Kim ^[8]	PPV1	PPV2
Amorphous							
Diffuse	NA	NA	NA	NA	0(0/1)	0(0/1)	0(0/3)
Regional	67(2/3)	29(2/7)	NA	0(0/6)	4(1/24)	12(5/40)	19(6/31)
Grouped	24(7/29)	17(17/100)	13(3/24)	18(6/34)	8(7/92)	14(40/279)	14(6/42)
Linear/ Segmental	0(0/1)	42(5/12)	17(1/6)	36(4/11)	20(2/10)	30(12/40)	20(2/10)
Coarse heterogeneous							
Diffuse	NA	NA	NA	NA	0(0/2)	0(0/2)	NA
Regional	NA	NA	NA	NA	20(2/10)	20(2/10)	0(0/2)
Grouped	NA	NA	7(1/14)	25(2/8)	13(7/53)	13(10/75)	17(1/6)
Linear/ Segmental	NA	NA	NA	0(0/2)	50(4/8)	40(4/10)	50(1/2)
Fine pleomorphic							
Diffuse	NA	NA	NA	NA	NA	NA	0(0/1)
Regional	NA	NA	0(0/1)	0(0/3)	NA	0(0/4)	0(0/15)
Grouped	NA	NA	22(6/27)	26(9/34)	41(9/22)	29(24/83)	38(10/26)
Linear/ Segmental	NA	NA	67(4/6)	39(5/13)	94(15/16)	69(24/35)	85(22/26)
Fine linear or Fine linear branching							
Diffuse	NA	NA	0(0/1)	NA	NA	0(0/1)	NA
Regional	0(0/1)	NA	NA	NA	NA	0(0/1)	NA
Grouped	75(9/12)	NA	36(4/11)	40(2/5)	100(1/1)	55(16/29)	NA
Linear/ Segmental	89(16/18)	NA	86(6/7)	78(14/18)	100(7/7)	86(43/50)	100(6/6)
Total	53.1(34/64)	22.7(24/119)	25.8(25/97)	31.3(42/134)	22.4(55/246)	27.3(180/660)	31.8(54/170)

PPV1: PPV according to previous studies; PPV2: PPV according to our study; NA: not applicable

(PPV=9%)、成簇分布钙化为4B类(PPV=14%)、线样及叶段分布钙化为4C类(PPV=88%、PPV=64%)。本研究显示弥漫、区域、成簇、线样及叶段钙化的PPV分别为0%、12%、23%、60%及76%。依据BI-RADS分类标准,弥漫分布钙化为2类、区域及成簇分布钙化为4B类、线样及叶段钙化为4C类,与BI-RADS一致。

在实际临床工作中,钙化的BI-RADS评估分类必须综合考虑钙化的形态和分布,少数研究提出了运用钙化形态和分布系统地预测钙化恶性可能的方法,但是这些方法并未显示PPV,并未依照BI-RADS进行分类^[4, 14]。本研究结合钙化分布后,结果显示,弥漫分布的不定形及细小多形钙化、区域分布的粗糙不均质及细小多形钙化均可

降为2类,不需组织活检;区域、成簇、线样及叶段分布的不定形钙化,成簇、线样及叶段分布的粗糙不均质钙化,成簇分布的细小多形性钙化仍为4B类;线样及叶段分布的细小多形钙化仍为4C类;线样及叶段分布的线样或线样分枝钙化升为5类。笔者总结既往文献报道钙化形态和分布组合的PPV,见表5。对比既往研究,本研究区域分布的粗糙不均质钙化PPV为0%(BI-RADS 2类),低于既往研究的20%(BI-RADS 4B类);线样及叶段分布的线样或线样分枝钙化PPV为100%(BI-RADS 5类),高于以往研究的86%(BI-RADS 4C类)。这两种组合分类的PPV差异可能因本研究样本量较少有关。此外,以往多个研究的总例数补充了本研究样本量过少的缺陷,其显示弥漫分

布的粗糙不均质和线样或线样分枝钙化均可降为2类,不需组织活检。综上所述,可疑钙化的BI-RADS分类仍需综合考虑钙化的形态和分布。

总之,第五版BI-RADS对可疑钙化形态分类

的建议具有良好的临床应用价值。可疑钙化准确的BI-RADS分类仍需综合考虑钙化的形态和分布。因本研究样本量较少,需要扩大样本量进一步研究。

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