

# MR Pearl Sign: The value of MR cholangiopancreatography (MRCP) on diagnosis of Adenomyomatosis of the gallbladder

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**Introduction:** Adenomyomatosis of the gallbladder (AGB) is a relatively common disease. AGB is defined as epithelial proliferation and hypertrophy of the muscularis of the gallbladder with outpouching of the mucosa into the thickened muscular layer (RAS; Rokitansky-Aschoff sinus). It is known that AGB is classified into three different morphological types including diffuse, segmental, and fundal types. Based on such morphological appearances of AGB, AGB sometimes appear as focal lesion or localized or diffuse wall thickening of gallbladder which may resemble gallbladder carcinoma. Therefore, it is important to make an accurate diagnosis of AGB for the purpose of differentiation of gallbladder carcinoma from AGB on clinical setting, because AGB is benign condition and does not require any therapy if patients with AGB show no clinical symptoms unlike gallbladder carcinoma. Radiologically, it is known that cholecystographic images with drip-injection of iodized contrast materials (DIC) specifically demonstrates opacified dilated RAS that is also known as "Pearl Necklace Sign" (1) However, such specific imaging features may not be often expected, because the gallbladder may not be filled constantly on DIC. Recently, a few investigators have addressed that heavily T2-weighted MR images may be helpful for diagnosing AGB because dilated RAS filled by bile within the thickening wall of gallbladder are demonstrated as markedly hyperintense areas on these images (2, 3). Especially, MRCP images obtained with single-shot fast spin-echo (SSFSE) sequences may be more expected than heavily T2-weighted fast spin-echo sequences for constant demonstration of dilated RAS due to faster scan time of SSFSE sequences. Therefore, the purpose of this study is to evaluate the value of MRCP images for the visualization of dilated RAS within the thickened wall of gallbladder (We call it as "MR pearl sign"). Moreover, we also investigate whether this sign of MRCP images is useful or not for differentiating gallbladder carcinoma from AGB.

**Materials and Methods:** 85 patients (51 males and 34 females; 33-87 years, mean 57 years) with gallbladder disease were retrospectively reviewed. Histologically, the final diagnoses were adenomyomatosis (n=29), chronic cholecystitis (n=41), and adenocarcinoma (n=15). MR imaging was performed 1.5-T superconducting units (Signa Horizon, GE Medical System and Magnetom Vision, Siemens) with phased-array multicolls. Single-slice (2-5 cm) or multislice (5 mm) MRCP images were obtained with SSFSE with Half-Fourier sequences (HASTE and SSFSE). Axial unenhanced and helical dynamic CT (slice thickness and table-moving speed; 5mm and 5mm/sec) and axial or oblique unenhanced and dynamic MR images with spoiled fast gradient-echo sequence (slice thickness and interslice gap: 5mm and 0-2 mm) were also performed in majority of the patients for comparison.

**Analysis:** Each imaging modality was interpreted by three blinded observers. The detection rates of the MR pearl sign (or RAS) for each modality were calculated. The abilities of each imaging modality for differentiating gallbladder carcinoma from AGB based on the presence of the MR pearl sign were assessed by Receiver operating characteristic (ROC) analysis based on a 5 point confidence scale. The relative sensitivity, specificity, and accuracy of each modality for the presence of the MR pearl sign were also calculated for ratings of 4 or 5 as positive. The 5 point confidence scale on MRCP was defined as follows. 1=definitely malignant (mass with extragallbladder extension), 2=possible malignant (polypoid lesion at gallbladder wall > 1cm), 3=equivocal (irregular wall thickness or polypoid lesion at gallbladder wall < 1cm), 4=possible benign (probably present of MR pearl sign or smooth wall thickness 5mm), 5=definitely benign (definitely present of the MR pearl sign).

**Results:** The detection rates of RAS (or the MR pearl sign) of each technique were 25% with dynamic CT, 21% with dynamic MR

images, and 76% with MRCP, 58% with MRCP+ dynamic MRI. The Az values of each modality for differentiating gallbladder carcinoma from AGB are shown in table 1. Relative sensitivity, specificity, and accuracy of the presence of RAS (or the MR pearl sign) are shown in table 2. MRCP images showed the highest detection rate of RAS (or the MR pearl sign) of all modalities. The Az values of MRCP alone and MRCP+ dynamic MR images were significantly higher than those of dynamic CT and dynamic MR images alone (P<0.05). There was no significant difference for the Az values between MRCP alone and MRCP+ dynamic MR images although MRCP+ dynamic MR images showed slightly higher Az value than that of MRCP alone. In seven of 29 patients with AGB (7/29,24%), the MR pearl sign was not identified on MRCP images. Pathologically, five of the seven patients without the MR pearl sign had mild form of RAS in which all RAS were too small (<2 mm) to be identified on MRCP images. In the remaining two patients, RAS was fully compacted with stone.

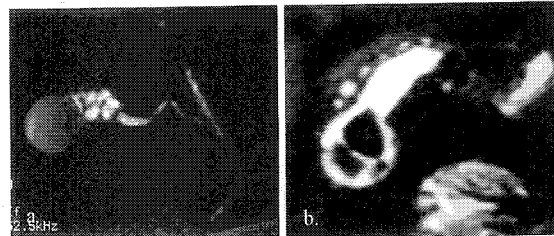
**Conclusion:** MRCP can frequently demonstrate dilated RAS within the thickened wall of gallbladder (the MR pearl sign) in patients with all morphological types of AGB. Moreover, the MR pearl sign is proved to be specific for AGB and to be more useful than dynamic CT and dynamic MR images for differentiating gallbladder carcinoma from AGB. While, it is considered that dynamic MR images may also helpful for differentiating gallbladder carcinoma from AGB in which the MR pearl sign may not be recognized on MRCP images.

Table 1. Az Values for ROC Analysis of Enhanced CT(E-CT), Enhanced MRI (E-MRI), MRCP, and MRCP+enhanced MRI

	E-CT	E-MRI	MRCP	MRCP +E-MRI
Reader 1	0.81±0.07	0.72±0.10	0.88±0.06	0.89±0.08
Reader 2	0.74±0.09	0.82±0.08	0.91±0.06	0.92±0.06
Reader 3	0.76±0.08	0.83±0.08	0.91±0.03	0.97±0.04
Total	0.76±0.05	0.79±0.05	0.91±0.03	0.93±0.03

Table 2. Relative sensitivity, relative specificity, and accuracy of MR pearl sign

	sensitivity	specificity	accuracy
Reader 1	69% (20/29)	92% (12/13)	76% (32/42)
Reader 2	48% (14/29)	100% (13/13)	64% (27/42)
Reader 3	72% (21/29)	100% (13/13)	81% (34/42)
Total	63% (55/87)	97% (38/39)	74% (93/126)



MR pearl sign (adenomyomatosis)  
 a. segmental type, b. diffuse type

## REFERENCES

- Dähnert. W. Radiology Review Manual 3'd ed. Williams & Wilkins, USA 542
- Kim M.J., Oh Y.T., Mitchell D.G., et al. Abdom Imaging (24) 410-413,1999
- Yoshimitsu K, Honda H, Masuda K, et al. AJR (172) 1535-1540, 1999