

# Color Doppler Twinkling Artifact Related To Sludge Of Gallbladder: A Case Report

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## Citation

B Keyik, B Yanik, I Conkbayir. *Color Doppler Twinkling Artifact Related To Sludge Of Gallbladder: A Case Report*. The Internet Journal of Radiology. 2009 Volume 12 Number 1.

## Abstract

Color Doppler twinkling artifact has been described in stones of urinary and biliary tract, parenchymal calcifications, medical materials such as encrusted ureteral stent, intracerebral coil. To the best of our knowledge this artifact has not been published in sludge of gallbladder before. This artifact is concerned to the strongly reflective structure and sonography machine settings. Twinkling artifact mimics a real blood flow in color mode Doppler examination and it may lead to wrong diagnosis. We present a case of twinkling artifact related to the sludge of gallbladder that might represent a trap in color Doppler imaging in the differential diagnosis of gallbladder tumor.

## INTRODUCTION

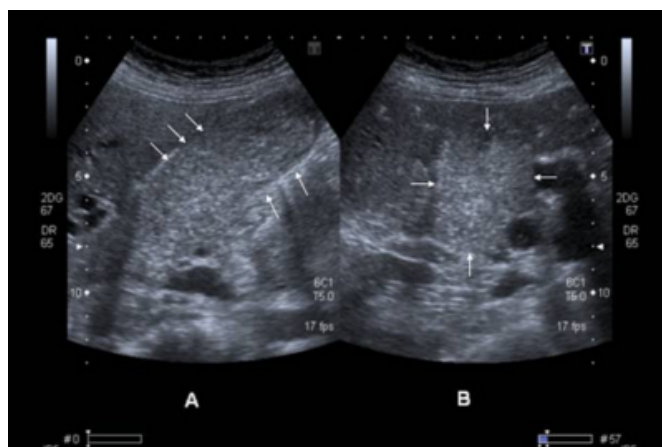
Twinkling artifact occurs as a rapidly changing mixture of red and blue color Doppler signal behind a reflective object, which gives the appearance of blood flow. Spectral mode of this artifact shows a fine heterogeneous broadband signal, and audio mode demonstrates treble squeaks (1). This artifact has been described in various locations, especially in the detection of renal or ureteral stones (2,3). This case report presents twinkling artifact due to the sludge of a gallbladder that can be represent a pitfall in color Doppler imaging in the differential diagnosis of gallbladder tumor.

## CASE REPORT

A 58-year-old male admitted to the hospital with abdominal discomfort in epigastrium and vomiting. There was no abnormal finding in physical examination. Chest roentgenogram was normal. Minimal elevation of the bilirubinate was detected in biochemistry examination. Gray-scale ultrasonography (US) and color Doppler US were obtained with a SSA-660 A Toshiba Xario ultrasound scanner (Tokyo, Japan) and a 3.5 MHz convex transducer. In abdominal gray-scale ultrasonography (US), luminal echogenicity of gallbladder was increased and internal echoes mimicking the homogeneous slightly hyperechoic solid mass filling to the entire the gallbladder lumen was detected (Figure 1A-B).

## Figure 1

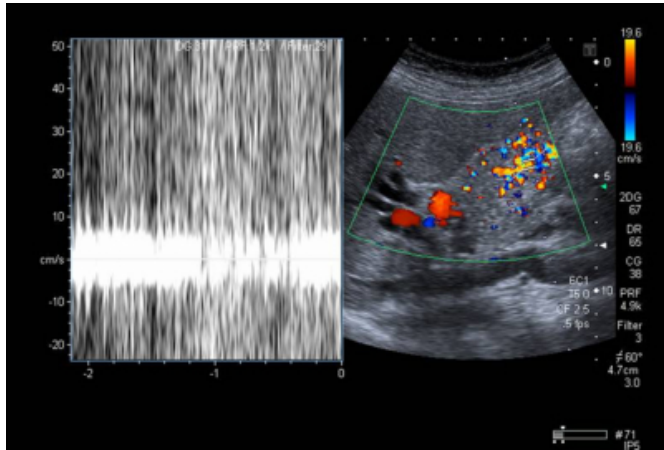
Figure 1. A-In sagittal plane and B- in transvers plane, gray scale US shows homogeneous slightly hyperechoic internal echoes in gallbladder lumen like as a solid gallbladder mass filling to the entire the lumen (arrows).



This appearance looked like a gallbladder mass at the first sight. However, the thickness of the gallbladder wall was normal and gallbladder wall was intact. Therefore, the gray-scale US findings of the gallbladder were interpreted as sludge of gallbladder. On color mode Doppler US, multiple color Doppler signal was detected in gallbladder lumen and mistakenly interpreted as vascularity. In spectral analysis of these color Doppler signals, an artifactual spectral signal with saturated amplitude was obtained (Figure 2).

**Figure 2**

Figure 2. Color mode Doppler image reveals multiple color Doppler signals in a gallbladder lumen and sample volume placed on the color Doppler signal demonstrates artifactual spectral signal with saturated amplitude.



In the light of these datas, the twinkling artifact was recognized. Finally, the over-all sonographic finding of the gallbladder was interpreted as sludge. The patient had a cholecystectomy operation for repeated jaundice attacks due to the sludge of gallbladder and the diagnosis was confirmed surgically.

## DISCUSSION

The first description of twinkling artifact was offered in 1996 by Rahmouni et al. (4). These authors suggested that the artifact is generated by rough interfaces with multiple reflectors splitting the incident beam into a complex beam pattern. However, some authors proposed that surface roughness alone is not enough to produce this artifact (1). Twinkling artifact is highly dependent on machine settings, and its appearance is dependent on color-write priority, gray-scale gain, and pulse repetition frequency. Besides, it is also probably dependent on the equipment used (1,2).

In relevant literature, twinkling artifact has been reported in various localization, especially in urinary stones and encrusted ureteral stents, in gallbladder stones, in coils used for embolization in cerebrovascular system, in adenomyomatosis of gallbladder, and in parenchymal calcification and in masses of various solid organ (3-7). To the best of our knowledge, the twinkling artifact on color Doppler imaging has not been described in sludge of gallbladder before.

Biliary sludge is defined as a mixture of particulate matter and bile that occurs when solutes in bile precipitate (8). The gray-scale US finding of sludge is that of low-level echoes

within the gallbladder in a dependent position, with no acoustic shadowing. The US findings of gallbladder tumor depend on the morphology of the mass. Gallbladder tumors may produce large quantities of mucin and the gallbladder lumen can be filled with debris-like low-level echoes with thickened wall and/or solid polypoid mass on the gray-scale US (8,9). Lack of the internal vascularity is one of the clue to the presence of the sludge on color Doppler US (8). Color and spectral mode of Doppler US revealed intraluminal mass and/or gallbladder wall in gallbladder tumor (9). Gallbladder tumors are differentiated from non-neoplastic abnormalities by immobility of the mass, larger size (> 1 cm), loss of wall definition and prominent vascularity on gray-scale US and color Doppler US (8,9). In our patient, lumen of gallbladder echogenicity was increased due to sludge and there was no mobility of the sludge with the change in the position of the patient like as a solid gallbladder mass filling to the entire the lumen in gray-scale US at the first sight. However, the gallbladder wall was intact. Color mode Doppler US of sludge of the gallbladder showed multiple color Doppler singals which might be mistakenly interpreted as real blood flow signal if the spectrum was not analysed. Therefore, flow spectrum should always be analysed when a color Doppler signal is observed in color Doppler imaging. If the spectrum is composed of close vertical bands with no outer wrapping, the color Doppler singal should be interpreted as twinkling artifact.

The recognition of the twinkling artifact in sludge of the gallbladder is important as it simulates a real blood flow, a finding that may indicate the presence of a vascular gallbladder tumor.

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