Volume Changes in Gallbladder in Association with Intravenous Use of Nonionic Contrast Agents

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KEY WORDS
contrast media, gallbladder, ultrasound

Background: To determine whether use of intravenous (IV) nonionic contrast agent affects the gallbladder (GB) volume in the preceding sonographic imaging.

Materials and methods: The GB volume was measured sonographically before and 15 minutes after the IV contrast agent injection in 200 patients referred to the teaching hospitals of Mashhad University of Medical Sciences (Mashhad, Iran).

Results: There was a statistically significant difference between GB volumes after the injection of contrast media (19.59 ± 4.49 compared with 16.06 ± 3.89 m³, respectively; p < 0.001). However, no statistically significant difference in GB volume changes was found in male and female patients or in patients over the age of 45 or below.

Conclusion: The GB volume reduces 15 minutes after IV use of the contrast agent. This reduction should be taken into consideration when ordering an imaging modality with IV contrast injection accompanied by ultrasound evaluation of GB.

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Introduction

It has been long known that the best diagnostic tool for gallbladder (GB) evaluation is ultrasound. It is cost effective and easy to use, and is sometimes the only available tool. That is why it should be performed under optimal conditions. To evaluate the GB adequately and correctly, it should be fully distended. After food consumption, the GB
is stimulated and contracted, which can lead to misinterpretation of the sonographic examination results. To prevent this contraction, ultrasound examination should be performed after a minimum of 6 hours of fasting [1]. Sometimes patients are referred to radiology departments with multiple imaging requests, some of which require intravenous (IV) or oral administration of contrast media. If this administration has an effect on GB volume, it might result in misinterpretation of the sonographic data. Therefore, IV administration of contrast media should precede sonographic examination [2].

Previous studies have indicated that the use of contrast agents leads to contraction of GB, questioning the accuracy of ultrasound evaluation of GB performed after their administration [3,4]. The data regarding GB volume changes following administration of contrast media in the literature are scarce and are limited to only one population. Therefore, it is not yet clear whether such an effect occurs in other populations as well. Because sonographic evaluation of GB is a routine and vital diagnostic tool, it is necessary to determine whether administration of contrast media affects GB volume or not.

This study is performed to investigate whether IV nonionic contrast agents affect the GB volume or not in Iranian population.

Materials and methods

Between December 2009 and July 2010 a total of 200 patients were enrolled in this study. The study, designed as a before-and-after study, was performed in two teaching hospitals of Mashhad University of Medical Sciences (Mashhad, Iran) on patients referred to the Radiology Department for an IV pyelography or computed tomography scanning with IV contrast injection.

Ethics approval was obtained from the Ethics Committee of Mashhad University of Medical Sciences. An informed written consent was also obtained from each participant.

Exclusion criteria were a history of biliary duct diseases, any previous gastric surgery, diabetes mellitus, intra-abdominal infection, history of gastrointestinal malignancies, cholelithiasis, and GB diseases.

All the participants in the study received IV contrast agents ($N = 200$). The contrast used in this study was 300-mg ULTRAVIST (Bayer, Leverkusen, Germany).

The study was conducted in the morning and all patients were fasting. All the ultrasounds were performed by the same radiologist and the GB volume was measured sonographically, both before and 15 minutes after administration of the contrast agent, using a 5-MHz probe (Hitachi EUB 525). Volume difference before and after the administration of the contrast agent was calculated using the planimetric method of volume calculation, which is simpler and more precise according to some studies [5] ($\text{length} \times \text{width} \times \text{height} \times \pi/6$), and the values are recorded for analysis (Figs. 1 and 2). This method was first described by Dodds et al [6].

Comparison between GB volume before and after using IV contrast agent was analyzed by the paired $t$ test. Independent $t$ test was used for comparison between male and female participants. For an easier evaluation, we used a cut-off point of 45 years to divide our participants into two almost equal-sized subgroups. An independent sample $t$ test was used to compare two different age categories with 45 years as a cut-off point. The analysis was performed using SPSS version 16 (Chicago, IL, USA). A $p$ value $< 0.05$ was considered statistically significant.

Results

Participants included a total of 200 patients of which 54% ($n = 108$) were female and 46% ($n = 92$) were male. The age of patients ranged from 27 to 65 (mean: $43.3 \pm 9$ years).

Table 1 shows the GB volume, height, width, and length before and after the injection of the contrast medium.

Table 2 shows the GB volume stratified by gender and defined age before and after administration of contrast medium.

According to the analysis, the difference between GB volume before and after IV administration of the contrast media...
medium was statistically significant. It demonstrated that GB volume is reduced when using IV contrast agents.

Volume changes were also analyzed in women and men separately. The volume changes in men and women were 3.85 ± 0.42 and 3.26 ± 0.37, respectively, which were not statistically significant (p = 0.291). It can be concluded that volume changes is not affected by gender. The difference in volume changes in those patients over the age of 45 and those younger was also analyzed. Volume changes were 3.7 ± 2.09 mL in participants who were over the age of 45 and 3.4 ± 2.29 mL in the younger group. The results of this analysis show that age does not affect volume changes significantly (p = 0.599).

Discussion

This study, performed on a total 200 patients, revealed that the GB volume reduces 15 minutes after IV use of contrast agent. To our knowledge there have only been three studies with the aim of addressing the influence of IV contrast media on the size of GB. All of these studies had been performed on Turkish population. Clearly more research using larger sample sizes are needed before extrapolating the data of these studies on other populations. Our study used 200 patients and was conducted on a Persian population. Nevertheless, our results are in corroboration with those of previous studies.

In 1999, Khan et al performed a prospective study on 77 patients to evaluate the effects of IV or oral contrast agents on GB volume changes in patients without known GB disease. He demonstrated that the GB volume was decreased by 24.8%, which was significant (p < 0.01). He concluded that the use of both IV and oral contrast agent leads to GB contraction [3].

The same group had a further research in 2001 to determine whether it is possible to evaluate GB sonographically after using oral or IV iodinated contrast agents in the same day or not. This prospective study included 153 patients, of which 66 received IV contrast agents. The mean volume after contraction at 0.5 hours was 71% after IV contrast agent administration and the change was significant (p < 0.01) [7].

In 2005, Nazaroglu et al conducted a study to evaluate the volume changes of GB after IV administration of nonionic, iodinated contrast agents with or without ingestion of contrast agent or water. He concluded that the volume of GB was reduced after the administration of the contrast agent and this reduction was statistically significant and concluded that it might interfere with the sonographic evaluations of GB [8].

Based on our data and those of previous studies, we could collectively conclude that if GB diseases are suspected, any diagnostic imaging modality involving the use of contrast agents should be performed after the sonographic examination of the GB or it should be postponed until renormalization of GB volume. However, it is not clear as to when such renormalization may occur. We suggest that further investigations with larger sample sizes are needed for a better and more definite assessment of the effects of IV contrast media on GB volume.

We also suggest a newly designed study on patients with different type of biliary diseases to evaluate the probable impact of different diseases on the GB volume changes after IV contrast injection.

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References

