International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR |Volume 7 | Issue 3 | Jul - Sep - 2019
www.ijamscr.com

Research article *Medical research*

Iron supplements in suppressing gastric Signal on MRCP

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ABSTRACT

The biliary system image on MRCP examination is often disrupted by artifacts due to signals from the stomach and duodenum. To eliminate this signal artifacts, an intra-oral negative contrast medium is required. On the market there are artificial contrast media but have a price that is quite expensive, and difficult to obtain. Iron supplement solutions have a paramagnetic iron content so they can be used as a substitute for negative contrast media sold on the market. To analyze the differences in gaster SNR values on MRCP examination between before and after administration of Iron supplement solution as an alternative to negative oral contrast media. This type of research is quasi experimental with Pre-test Post-test design. The subjects of the study used 10 samples of healthy volunteers by doing scaning pre-contrast, post contrast Scaning protocol uses HASTE Fat Saturation T2 Coronal Thick Breath Hold. The result of the image is measured by the signal value to calculate the SNR and then do a different test. There were differences in gastric SNR values between Pre Contrast with post contrast (p-value < 0,001). Iron supplement solutions can be used as negative oral contrast media for MRCP examination

Keywords: *MRCP, HASTE, Iron substances, Negative contrast media.*

INTRODUCTION

Biliary system disease is a disease that affects the bile ducts, gall bladder and other structures involved in the production and transportation of bile [1]. In Asia the prevalence of gallstones is increasing along with poor diet in the community, but in Indonesia there is no prevalence because there is still little research on gallstones [2]. Data reported by RSUP Prof. Dr. R. Kandou Manado, the number of gallstone cases in the period October 2015 - October 2016 in the medical record section as many as 113 cases with 83% cases of gallbladder stones and 17% cases of bile duct stones [3]. The results of research conducted at Koja Hospital in the period 5 October 2015 - 31 December 2015 there were 102 patients with gallbladder stones with 37% men and 63% women [4].

Magnetic Resonance Cholangio Pancreatography (MRCP) is an examination technique used to evaluate gallbladder and its ducts using non-invasive use of magnetic and radiofrequency fields without using radiation as in ERCP [5, 6]. MRCP has a sensitivity between 91% and 100%, a specificity value of 92% to 100% and a positive positive value between 93% and 100% in circumstances with suspected bile duct stones. A high diagnostic value makes MRCP increasingly

used in diagnostic management, especially bile duct stones [7].

The image results on MRCP examination often occur overlapping between pancreatobiliary signals with signals from the gastrointestinal tract (stomach, duodenum) which can obscure the picture of pathology [5, 8]. Fluid signals in the stomach and duodenum can be removed by administering negative oral contrast media containing metal ions such as Iron (Fe) and Manganese (Mn) substances which can shorten the relaxation time and reduce the T2 signal in the stomach and duodenum [5, 8].

The material used as an iron-based negative contrast medium that has been studied is palm juice [9]. Iron content of date palm juice used in the study was 10mg / 100gr. The disadvantage of date juice is that it has a very high level of thickness, so it requires a long time from the stomach to enter the duodenum [9].

One ingredient that has an iron content in large quantities is an Iron supplement. This iron supplement will be used as an alternative to negative oral contrast media on MRCP examination. Iron Supplements contain iron of 28 mg [10]. Iron supplements have a cheap price, the solution has a low viscosity, it tastes good because it has a cranberry flavor.

Iron is one of the ingredients that can be used as a negative oral contrast medium because it has superparamagnetic properties, namely a material that has a very high magnetic susceptibility so that it is easily affected by the external magnetic field [11, 12]. Paramagnetic or superparamagnetic materials such as iron have a very fast T2 decay time, thus reducing signal intensity at weighting the density or weighting of T2 protons [11, 12].

SUBJECT AND METHODS

Subject

This type of research is quasi-experimental research with Pre-test Post-test design. The subjects of this study were 10 healthy volunteers who underwent MRCP examination with standard preparation of each 14 hour fat diet and fasting 8 hours before examination. The treatment is in the form of oral iron supplements which are then scanned with the time to start scaning 2 minutes after iron supplementation. Volunteers chosen were healthy volunteers, not pregnant, had no claustrophoia history, had no metal implants, had no history of liver disease, pancreatobiliary system, and gastrointestinal system.

Oral Contras Agent

Oral contrast agent in the form of a solution made of 2 iron tablets dissolved in water as much as 200 ml with a total iron content of 56 mg.

MRCP Protocol

MRCP Scaning is done using a protocol T2 HASTE Fat Saturation Coronal Thick Breath Hold. TR 4500, TE 742, Slice Thicknes 50 mm, flip angle 180, respiratory breath hold.

Image assessment

Assessment of MRCP image quality was carried out on the effect of negative oral contrast media on the value of the Signal to Noise Ratio (SNR) of the stomach. Measurements are carried out by radiographers in good health, working in the radiology unit of the MRI for more than 5 years and having experience conducting MRCP examinations. Measurements were made by making ROI with a diameter of approximately 0.5 mm^2 in the stomach area.

RESULT

The MRCP scaning results obtained by each study sample amounted to 2 MRCP images, including 1 MRCP image before giving Iron supplement solution and 1 MRCP image after Iron supplementation.

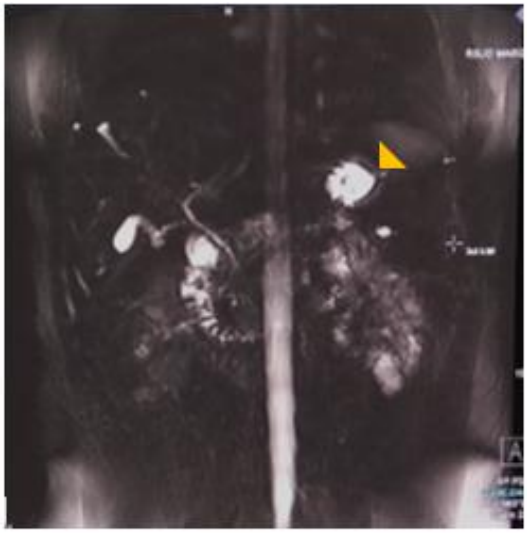

Figure 1: MRCP image before administration of Iron supplement solution

Figure 2: MRCP image 2 minutes after administration of an iron supplement solution

Figure 1 is the result of MRCP imagery before administration of an iron supplement solution. The appearance of the biliary system is accompanied by hyperintense gastric artifacts (yellow triangles). Figure 2 is the result of MRCP scaning images 2 minutes after administration of an iron supplement solution. A picture of the biliary system. Gastric artifacts appear hypointense (yellow triangle) that are hypointense.

The results of measurement of gastric SNR values before and after administration of Iron supplement solutions with time variations are presented in table 1.

Tabel 1: Gastric SNR before and after administration of an iron supplement solution

	SNR ± Standar Deviasi	**p-value**
Pre Contrast	552,05 ± 237,85	< 0,001
Post Contrast	27,44 ± 16,17	

Table 1 shows the SNR value decreases after administration of an iron supplement solution. Different tests showed that there were differences in the overall gastric SNR value between before and after iron supplementation with p-value <0.001.

DISCUSSION

Magnetic Resonance Cholangio Pancreatography (MRCP) is an examination technique used to evaluate the gall bladder and its ducts using non-invasive use of magnetic and radiofrequency fields without using radiation as in ERCP [5, 6]. This study used an iron supplement solution as a negative oral contrast medium on MRCP examination. The iron dose used in the study was 56 mg in 200 ml of the solution.

Iron is one of the ingredients that can be used as a negative oral contrast medium because it has superparamagnetic properties, namely a material that has a very high magnetic susceptibility so that it is easily affected by the external magnetic field [11, 12]. Paramagnetic or superparamagnetic materials such as iron have a very fast T2 decay time, which will reduce signal intensity at weighting the protons density or weighting of T2 [11, 12].

Signal to Noise Ratio (SNR) is the ratio of the amplitude of the signal received at the average amplitude of the noise [13]. This study uses SNR parameters to assess the intensity of gastric signals. High gastric SNR values indicate a high signal in the stomach.

There is a difference in gastric SNR value between before and after administration of an iron supplement solution. Inside the stomach, the iron contained in the iron supplement solution will mix with gastric fluid so that stomach fluid which initially has a long T2 relaxation time will be faster. Iron Supplements mixed with gastric fluid will accelerate T2 relaxation time, so the fluid in the stomach becomes hypointense.

CONCLUSIONS

There is a difference in the gaster Signal to Noise Ratio (SNR) of the MRCP image before and after the administration of an iron supplement solution.

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How to cite this article: Susi Tri Isnoviasih, M. Choiroel Anwar, Rini Indrati, Gatot Murti Wibowo, Siti Masrochah. Iron supplements in suppressing gastric Signal on MRCP. Int J of Allied Med Sci and Clin Res 2019; 7(3): 784-788.
Source of Support: Nil. **Conflict of Interest:** None declared.