Oolong Tea Drink as an Alternative to Oral Negative Contrast Media in Magnetic Resonance Cholangio Pancreatography (MRCP)

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ABSTRACT

Background: High signal intensity of the gastrointestinal system can disrupt the optimization of MRCP image quality. Research on the use of natural oral contrast media of MRCP has been widely used, but contrast media material is difficult to obtain in the developing country market such as Indonesia.

Methods: Based on Atomic Absorption Spectrometry (AAS) test the manganese content of oolong tea brand packaged is 0.9 mg larger than other packaged tea products. Therefore this study aims to evaluate oolong tea packaged as an alternative to oral MRCP contrast medium and to determine the best start scanning time settings. The subjects of the study were 28 healthy respondents, consisting of one control group and three treatment groups. The treatment group was given a 400 ml oolong tea package then 3D MRCP thick slab axial HASTE scanning was performed after 5 minutes (treatment 1), 15 minutes (treatment 2) and 25 minutes (treatment 3). The MRCP image assessment uses grading based on contrast and image effects.

Results: The results showed that there was a difference of MRCP image on the enhancement of contrast and image effect. The stomach and duodenum can be compressed into hypointense as well as the visualization of the choledochal, and the hepatic ducts appear more clearly at the start of a 15-minute scanning and 25-minute post contrast. Visualization of the ampulla, pancreatic ducts, and intra-hepatic ducts showed no difference between pre and post contrast.

Conclusion: Oolong tea in a form of a ready-to-drink package is as effective as other negative contrast media when used in Magnetic Resonance Cholangio Pancreatography (MRCP).

Keywords: Resonance Cholangio Pancreatography (MRCP), contrast media, oolong tea.

INTRODUCTION

Magnetic Resonance Cholangio Pancreatography (MRCP) is an alternative to the examination of the biliary system to evaluate the pancreatobiliary system and to reveal images of the ampulla, biliary duct, hepatic ducts, and intrahepatic central ducts without the use of contrast media.¹² MRCP examination in determining obstruction in the biliary ducts has a sensitivity of 96%, 86% specificity, and 90% accuracy. In detecting choledocholithiasis, MRCP examination has a sensitivity of 86%, 90% specificity, and 89% accuracy.³

In general, MRCP examination is done without using contrast media, but when overlapping occurs between the gastrointestinal and pancreatobiliary system, it will produce a false structure picture. The overlapping state of the MRCP examination may result in an unexpected increase in signal intensity. Diagnostic errors of MRCP examination include the frequent occurrence of fluid in the stomach or duodenum estimated as pancreatobiliary system pseudolesion. The fluid located between the folds of the stomach although this is normal may be considered as fluid in the ecstatic pancreatic ducts. Likewise, fluid and air in the duodenal bulb can be regarded as gallstones.¹⁴⁵
Oral negative contrast media used for examination of the abdominal area is gadopentetate dimeglumine, ferric ammonium citrate, manganese chloride, kaolinite, antacid, barium sulfate and ferric particles. Ironically, oral negative contrast media is rarely used because it is not manufactured as it is perceived as uncomfortable, difficult to swallow and expensive(6).

This study aims to find an alternative to using natural oral negative contrast media on MRCP examination. The use of natural oral negative contrast in the form of liquids or juices in both fruits and drinks shows a very various best start time for scanning after drinking. The oral contrast medium of blueberry and pineapple juice indicate the best scanning start time is 15 minutes after drinking contrast media (6,7). The use of lemon juice, favorite beverages, and black tea as a contrast medium is not explained when the best time to start scanning is (8, 9, 10). The start time of scanning is essential to obtain an optimal MRCP image. This study aims to provide an alternative natural oral negative contrast media that can be used for MRCP examination and to find out the best start time scanning when using negative oral contrast medium of Oolong tea. In the family tree of Chinese teas, Oolong tea which is semi-fermented lies between un-fermented green tea and fermented black tea (called black tea in the West but known as red tea in China). The range of fermentation varies from 8% to 70%. Oolong is sometimes written as Wulong, but the meaning is the same: Oo (Wu) means black and long means dragon. Oolong tea is also known in China as “Qing Cha.”

Ready-to-drink packaged oolong tea is selected as based on Atomic Absorption Spectrometry (AAS) test; it has the highest manganese content (0.90 mg) compared to other types of tea drinks. In this study, the variation of time is analyzed to find the best scanning start time after the respondents are given the oolong tea.

**METHODOLOGY**

This research is an experimental research with Randomized Pretest-Posttest Control Group Design (11). The sample of this study was healthy respondents with inclusion criteria; aged 25-55 years, in good health, willing to follow the course of research and with exclusion criteria; pregnancy, claustrophobia, Body Mass Index (BMI) > 30. The number of samples is at least seven respondents per group; consisting of 1 control group and three treatment groups, resulting in a total of 28 respondents. Determination of sample applies simple random sampling (12). Before the MRCP examination, the respondents underwent fasting for six hours. The control group was not given negative oral contrast medium of oolong tea. The treatment group was administered the negative oral contrast media of oolong tea with different scanning time commencing; 5 minutes, 15 minutes and 25 minutes post contrast. Assessment of MRCP image information was performed by three radiologists using grading 1-4 on the negative oral contrast media effect on signal intensity and grading 0-3 on the impact of pancreatobiliary tree image system (7). Data were analyzed with Paired T-Test, Wilcoxon Sign Test, One Way ANOVA Test, and Kruskal Wallis Test.

**RESULTS**

The oral negative contrast media effects of oolong tea drink on the intensity of gastric and duodenal signals can be observed in Table 1. There was no difference in gastric and duodenal signaling intensity before and after oolong tea drink administration in the control group shown with p-value = 0.317. There is a difference in the strength of gastric and duodenal signals after the administration of the drink under different interval times; 5 minutes post contrast (p = 0.015), 15 minutes post contrast (p <0.001) and 25 minutes post contrast (p <0.001).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre</th>
<th>Post</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 minute</td>
<td>2 ± 0.00</td>
<td>2.14 ± 0.378</td>
<td>0.317</td>
</tr>
<tr>
<td>5 minutes</td>
<td>2 ± 0.00</td>
<td>5.57 ± 5.35</td>
<td>0.015</td>
</tr>
<tr>
<td>15 minutes</td>
<td>2 ± 0.00</td>
<td>6.14 ± 0.690</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>25 minutes</td>
<td>2 ± 0.00</td>
<td>5.57 ± 1.134</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The effects of negative oral contrast media of oolong tea packaging on the image of the pancreaticobiliary tree system on gallbladder (GB), cystic duct (CD), common hepatic duct (CHD), intrahepatic duct (IHD), common bile duct (CBD), pancreatic duct PD), ampulla (A), can be seen in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre</th>
<th>Post</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 minute</td>
<td>12.29 ± 2.289</td>
<td>12.57 ± 2.370</td>
<td>0.172</td>
</tr>
<tr>
<td>5 minutes</td>
<td>10.86 ± 2.610</td>
<td>10.14 ± 2.478</td>
<td>0.047</td>
</tr>
<tr>
<td>15 minutes</td>
<td>11.43 ± 1.718</td>
<td>13.43 ± 1.618</td>
<td>0.010</td>
</tr>
<tr>
<td>25 minutes</td>
<td>11.29 ± 1.890</td>
<td>12.57 ± 1.397</td>
<td>0.063</td>
</tr>
</tbody>
</table>
There was no difference of conspicuity level of pancreatobiliary tree system after administering of oolong tea beverage in control group as showed by \( p = 0.172 \). The same was true in the treatment group with 25 minutes post contrast time where \( p = 0.063 \). But the treatment group of 5 minutes and 15 minutes post contrast showed there were differences respectively with \( p = 0.047 \), and \( p = 0.010 \).

The negative oral contrast media effects of oolong tea drinks on inter-group gastric and duodenal signaling intensities are shown in Table 3.

### Table 3: The intensity of gastric signals and duodenum

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
<th>Mean Rank</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 minute</td>
<td>2.14 ± 0.378</td>
<td>4.50</td>
<td>0.001</td>
</tr>
<tr>
<td>5 minutes</td>
<td>5.57 ± 5.35</td>
<td>16.57</td>
<td>0.001</td>
</tr>
<tr>
<td>15 minutes</td>
<td>6.14 ± 0.690</td>
<td>20.71</td>
<td>0.001</td>
</tr>
<tr>
<td>25 minutes</td>
<td>5.57 ± 1.134</td>
<td>16.71</td>
<td>0.001</td>
</tr>
</tbody>
</table>

There was a difference in the intensity of gastric and duodenal signals after administration of negative oral contrast medium of oolong tea drink with \( p \)-value 0.001 (\( p <0.05 \)). The highest strength of gastric and duodenal signals is at 15 minutes post contrasted with mean rank of 20.71 and the mean intensity of gastric and duodenal signals is of 6.14 ± 0.690.

### Table 4: The intensity of gastric and duodenal signals

<table>
<thead>
<tr>
<th>Variable</th>
<th>5 minutes</th>
<th>15 minutes</th>
<th>25 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 minute</td>
<td>( p = 0.001 )</td>
<td>( p = 0.001 )</td>
<td>( p = 0.001 )</td>
</tr>
<tr>
<td>5 minutes</td>
<td>–</td>
<td>( p = 0.114 )</td>
<td>( p = 0.891 )</td>
</tr>
<tr>
<td>15 minutes</td>
<td>–</td>
<td>–</td>
<td>( p = 0.284 )</td>
</tr>
</tbody>
</table>

There was a difference between the control with post contrast groups in all scanning starting time either 5 minutes (\( p = 0.001 \)), 15 minutes (\( p = 0.001 \)) or 25 minutes (\( p = 0.001 \)). There was no difference in the intensity of gastric and duodenal signals between the 5-minute and 15-minute post contrast groups (\( p = 0.114 \)); 5 minutes with 25 minutes post contrast (\( p = 0.891 \)); 15 minutes with 25 minutes post contrast (\( p = 0.284 \)).

Further observation result indicated that there was a difference of clarity level (conspicuity) of pancreatobiliary tree system at each scanning time with \( p = 0.033 \). The difference of conspicuity level between groups of 5 minutes and 15 minutes with \( p \) value = 0.027 (\( p <0.05 \)). There was no difference of conspicuity level between control group and 5 minutes post contrast (\( p = 0.139 \); 15 minutes post contrast (\( p = 0.857 \)); 25 minutes post contrast (\( p = 1.000 \)); between 5 minutes and 25 minutes post contrast (\( p = 0.139 \)) and between 15 minutes and 25 minutes post contrast (\( p = 0.857 \)).

### DISCUSSION

There is a difference in the intensity of gastric and duodenal signals between before and after treatment. Most of the magnitude of gastric and duodenal signals is suppressed, although not yet optimal. Since Oolong tea manganese levels can shorten relaxation time, the post-contrast posture and duodenal picture appear more hypointense (Figure 1).

![Before (a)](image)

![After 5 minutes drink (b)](image)

**Figure 1: Pre MRCP image and 5 minutes post contrast**

Figure 1 shows the stomach and duodenum of post-contrast MRCP image results not suppressed by oral negative contrast media of oolong tea drink maximally, but the post-contrast posture and duodenal picture look more hypointense compared with the contrast hull image. For negative oral contrast media to suppress the maximum gastric view can be done by setting a longer Time Echo (TE).
This research applied TE of 700 ms needed to extend to be more than 800 ms. The longer the TE will be the more spin relaxation in the stomach and duodenum that the relaxation time of the stomach and duodenum can be further shortened making the depressing and duodenal stomach becomes more depressed in the MRCP image. However, the precision of this TE setting needs to be considered, because a lengthy TE will cause an artifact (noise).

The intensity of gastric and duodenal signals in the control group and the treatment group experienced a lot of emphases, but in the treatment group did not undergo much change of focus. The intensity of the gastric and duodenal signals in the contrast post, 5 minutes, 15 minutes and 25 minutes after oolong tea showed the same signal intensity (hypointense), but could not be maximally depressed. The longer time to start scanning does not change the magnitude of the stomach and duodenal signals are getting depressed. Besides, the less content of manganese makes the time Echo (TE) is getting longer.

The 0.9 mg Manganese concentration in oolong tea drink can shorten the relaxation time of T2 by suppressing the intensity of gastric and duodenal signals as well as to reduce the relaxation time of T1 with the opposite effect on the stomach and duodenum. The availability of manganese intake from the drink will make the relaxation time of T1 accelerated that recovery is quicker and the picture is brighter (hyperintense).

Oolong tea drink is able to provide a good image effect on the pancreatobiliary tree system that is in the common bile duct and common hepatic duct (Figure 2). The intensity of the two sections signals the difference in image effect both in 5 minutes and 15 minutes post contrast when compared to the pre-contrast picture, but with 25 minutes post contrast, there is no difference in the effect of the image. This is due to the concentration of manganese on the pancreatobiliary tree system at 25 minutes post contrast has begun to decrease.

The gallbladder and intrahepatic duct display are seen during pre or post contrast, but there is no difference in image effect. Presentation of oolong tea contrast media was considered less able to distinguish the gallbladder and intra-hepatic duct enhancement on pre-contrast at 5 minutes, 15 minutes and 25 minutes post contrast. Intrahepatic duct can only be seen on the right and left hepatic duct branches whereas intra-hepatic duct peripheral is hardly seen because of the size is smaller where this result is consistent with the previous finding.

Pancreatic duct and ampulla are hardly seen in all MRCP images. Pancreatic duct is slightly oblique making difficult to show the entire pancreatic duct. The use of single Shot Fast Spin Echo (SSFSE) sequences will show pancreatic duct in the head (97%), body (97%), and tail (83%) (4).

Preparation of fasting aims to reduce the fluid in the stomach and is expected to have a little remaining liquid in the second part of duodenum useful as a landmark for the distal common bile duct and ampulla. Giving negative oral contrast media is helpful in suppressing signal intensity in the intestine, but ampulla is often invisible due to regurgitation from contrast media to ampulla (6).

Contrast media such as mangafodipir trisodium, used as an intra-venous negative contrast medium showed biodistribution in mice at 30 minutes after injection that 13% were in the liver, 9% in the small intestine, 3% in the blood and 1.3% in the kidneys (13).

Overall differences in MRCP image information both on oral negative contrast media effects on gastric and duodenal signal intensity as well as on the image effects of the pancreatobiliary tree system show that oolong tea drink can be used as an alternative to negative
oral contrast media that significantly improves MRCP imaging quality. However, further study is needed in clinical situations including modification of the accuracy of TE settings.

**CONCLUSION**

To sum up, giving negative oral contrast media in the form of ready-to-drink-oolong tea package can provide contrast media effect and significant image effect compared to the one without contrast media. The best time to start scanning after giving negative oral contrast medium of oolong tea packing is 15 minutes. Liquid oolong tea in the form of 300 ml bottles can be used as an alternative to negative oral contrast media in MRCP examination because it is safe, tasty, cheap and practical.

**Ethical Clearance:** The research received permission of ethical clearance from the Health Research Ethics Committee of Poltekkes Kemenkes Semarang. The authors would like to thank Health Ministry Polytechnic Semarang, Central Java, Indonesia for funding.

**Conflict of Interest:** Nil.

**REFERENCES**


