

Efficacy of Pineapple Juice as a Negative Oral Contrast in Magnetic Resonance Cholangiopancreatography

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ABSTRACT

Introduction: Magnetic Resonance and Cholangiopancreatography (MRCP) is a noninvasive test used in the evaluation of the pancreaticobiliary system. Pineapple juice (PJ) acts as a safe, cheap and readily available effective negative contrast which helps in increasing the conspicuity of the biliary system in MRCP. This study was done to find out the efficacy of pineapple juice as a negative contrast agent on MRCP

Methods: A cross-sectional study was conducted in the Department of Radiodiagnosis and Imaging from April 2023 to August 2023. Ethical clearance was taken and all consecutive patients fulfilling the criteria and undergoing MRCP over the study period of 3 months with effect from 8/04/2023 were included in the study.

Results: There was a significant improvement in the contrast effect scores between the pre-PJ and 30-minute post-PJ images ($p < 0.001$). Also, there was a significant improvement in the image effect score between the pre and 30-minute post-PJ images for visualization of the CBD and MPD.

Conclusions: This study demonstrated that a commercially available and easily consumable quantity of pineapple juice is effective as a negative oral contrast agent and improves the quality of MRCP imaging, specifically improving visualization of the CBD.

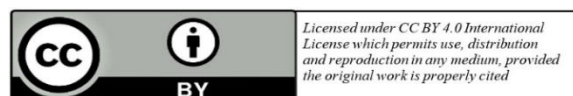
Keywords: *Ananas; Cholangiopancreatography, Magnetic resonance; Contrast Media.*

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INTRODUCTION

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive magnetic resonance imaging (MRI) procedure in imaging pancreatic duct and biliary tree which uses a heavy T2-weighted MRI sequence to eliminate soft tissue signal, thus

improving fluid signal from the duct.[1] MRCP can be used in patients with known or suspected biliary obstruction, cholangitis,



pancreatitis and congenital pancreaticobiliary anomalies.[2] Although Endoscopic Retrograde Cholangiopancreatography (ERCP) has enhanced the evaluation of these ducts and has both diagnostic and therapeutic roles, it is invasive, requires special preparation, utilizes ionizing radiation, and has relatively high morbidity.[3] MRCP is non-invasive modality which is capable of displaying diagnostic information equally as ERCP, other than no radiation received by the patient.[4] Oral contrast agents have been used as standardized examination protocols for MRCP which help in reducing superimposed fluid signal from the upper GI tract and hence improve the depiction of the pancreaticobiliary duct system. Negative oral contrast agents not only improve the depiction of the pancreaticobiliary duct system, but also aid with differential diagnoses.[5,6] Ferumoxsil, which consists of nano-sized iron oxide crystals coated with siloxane, is widely used for improvement of image quality in MRCP but it has displeasing, metallic taste and therefore reduces patients' compliance to ingest the required amount of contrast material.[7] Pineapple juice (PJ) has been shown to increase the conspicuity of the pancreatic duct, and also improving the visualization of the intrahepatic ducts, common hepatic ducts, common bile duct and ampulla on MRCP images. This effect is likely to be due to the paramagnetic effect of the relatively high manganese content of PJ, decreasing the T2 relaxation time of the fluid in the stomach and duodenum. Also, the advantage of PJ is that it is safe, cheap and readily available.[8]

No literature is available in Nepal to validate the effectiveness of pineapple juice in improving the image quality and therefore overall image interpretation of the

pancreaticobiliary system on MRCP. Therefore, the study intended to find out the role of pineapple juice as a negative contrast agent on MRCP.

METHODS

A cross-sectional study was performed from April 2023 to August 2023 in the Department of Radio Diagnosis and Imaging, Birat Medical College and Teaching Hospital and Birat Nursing Home, on all patients with pancreaticobiliary complaints referred for MRCP in the Radiology department of Birat Medical College and Teaching Hospital and Birat Nursing Home. Consecutive, purposive sampling was done to enrol the patients. All consecutive patients fulfilling the criteria and undergoing MRCP over the study period of 4 months with effect from 2/04/2023 were enrolled for the study. Ethical clearance was taken from the Institutional Board Committee (Ref) of Birat Medical College and Teaching Hospital. Informed consent was taken from the study participants. Data were entered in MS Excel and analyzed by SPSS.

MRCP were performed on the patients referred for the procedure following a six hour fast. Full informed consent was obtained. Pre-contrast images were obtained before PJ. Post-contrast images were obtained 15 minutes after oral administration of 400 ml of commercially available PJ. A standard SSH MRCP radial sequence was used (repetition time (TR) 8000 ms; echo time (TE) 800 ms; flip angle 90°; FOV 250 mm; 5 radial coronal oblique sections at 12° rotation; slice thickness 40 mm; breath hold) on a 1.5 Tesla Superconducting MR unit (GE) using a Synergy transmit/receive body coil. The images were blindly assessed, by two Consultant Radiologists experienced in the interpretation of MRCP. A standard quantitative scoring technique was used

based on (a) the contrast effect, defined as the extent to which the signals from the stomach and duodenum are eliminated and (b) the image effect, defined as the extent to which the diagnostic quality of the image (i.e. the conspicuity of various segments of the pancreaticobiliary tree) is improved. The contrast effect was assessed by grading all pre and post-pineapple juice images as one of four scores, using the following scoring system: 4=excellent, entirely no signal in the stomach or duodenum; 3=good, part of the stomach or duodenum showing high signal but not affecting reading; 2=fair, high signal intensity in part of stomach or duodenum adversely affecting reading; 1=poor, high signal intensity in part of the stomach or duodenum making reading difficult. For the image effect the conspicuity of various segments of the pancreaticobiliary tree were assessed using a 4 point grading system (0 to 3); such that 0=no visualization, 1=poor visualization, 2=moderate visualization, 3=complete visualization. Statistical analysis was performed with SPSS statistical software, using estimated marginal means and pairwise comparisons, to determine the statistical significance of differences between the mean contrast and image effect scores for the pre and 30 minutes post-PJ images. (A $p < 0.05$ was considered as the threshold for statistical significance).

RESULTS

A total of 34 patients underwent MRCP within the stipulated time. 3D images before and 30 minutes after pineapple juice were compared for the contrast and image effects. With a pre-contrast mean = 1.94, SD = 0.6 and a post-contrast mean = 3.21, SD = 0.72 ($P < 0.001$), there is a significant increase in contrast effect that is suppression of signal intensity from the gastrointestinal tract after

the administration of the pineapple juice. (Figure 1)

Table 1. Effect of pineapple juice as a negative contrast agent in magnetic resonance cholangiopancreatography

Characteristics	Pre-contrast		Post-contrast	
	Mean	SD	Mean	SD
SI from GIT	1.94	0.6	3.21	0.72
Visualization of CBD	1.15	0.74	1.94	0.85
Visualization of MPD	0.79	0.64	1.09	0.57

SI : signal intensity; GIT: gastrointestinal tract; SD: standard deviation; CBD : common bile duct; MPD: main pancreatic duct

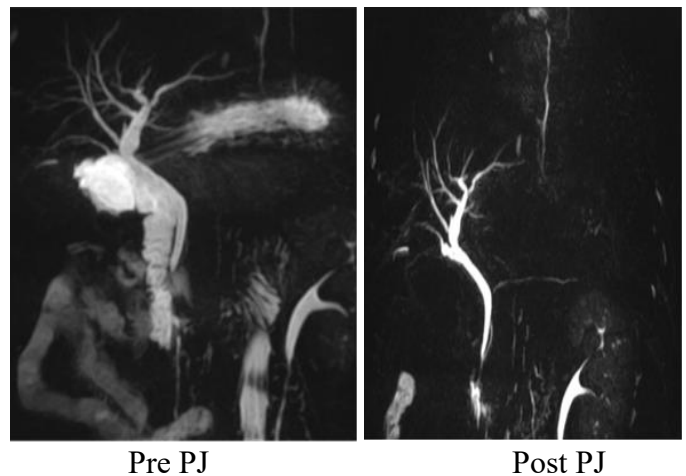
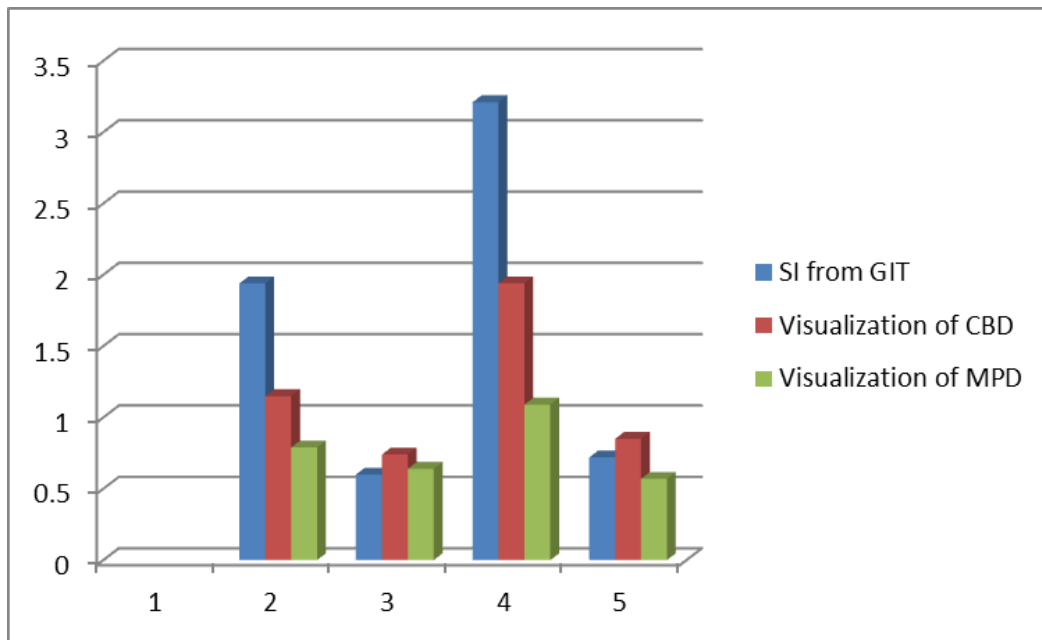


Figure 1. Pre and post-pineapple juice MRCP



SI : signal intensity; GIT: gastrointestinal tract; CBD : common bile duct; MPD: main pancreatic duct

Figure 2. Effect of pineapple juice as a negative contrast agent in magnetic resonance cholangiopancreatography

DISCUSSION

MRCP has stood the test of time in paving its path as an alternative to diagnostic endoscopic retrograde pancreatography (ERCP) in terms of diagnostic accuracy to image the pancreaticobiliary system, with an added edge of it being a noninvasive test requiring no instrumentation, special patient preparation, ionizing radiation, sedation or intravenous contrast material administration and also avoiding potential morbidity associated with complications of diagnostic ERCP (overall complications 5–10%, pancreatitis 5%, haemorrhage 1–2%, perforation, 1% and cholangitis 1.9%). [9] MRCP however bears a limitation due to possible overlap of heavily T2 weighted hyperintense signal intensity of the pancreaticobiliary system from similar hyperintense signals from adjacent GIT.[10,11] A systematic review of the existing literature was performed to evaluate the efficacy and efficiency of oral T2-signal suppressors in MRCP and it was found that twenty-five publications on 16 different oral contrast media were identified and the most commonly used

substances were ferumoxsil, ferric ammonium citrate, and pineapple juice. 23 out of 25 publications supported the use of oral signal suppressors in MRCP.[12] The concentration of manganese, which shortened T2 relaxation time and hence decreased T2 signal intensity on a standard MRCP in commercially available pineapple juice preparations ranges from 9.3 mg/L to 12.7 mg/L, which was shown to be effective for elimination of signal from the digestive tract.[13,14]

Riordan et al. showed a significantly improved visualization of the pancreatobiliary duct structures 15 minutes after oral intake of pineapple juice compared to pre-contrast imaging. However, they found no significant qualitative difference in diagnostic image quality for the ampulla, CBD, common hepatic duct, or intrahepatic ducts between precontrast and 30-min post-contrast MRCP.[8] Overall, our study data suggests that pineapple juice used in this study tends to suppress the signal intensities from the gastrointestinal tract, and aids in better visualization of the common bile duct, and the main pancreatic duct. There are no

reports of drug interactions or toxicity with PJ in the literature. Although side effects were not anticipated, this study confirmed the absence of any adverse effects.

The limitations of this study were that further significant suppression of GI signal intensities and improvement of pancreatic duct visualization may require further refinement in our MRCP protocol, including optimisation of the dose and timing of pineapple juice administration.

CONCLUSION

The study data suggests that pineapple juice can serve to suppress signals from GIT and thereby on enhancing the visibility of common bile duct and the main pancreatic duct. We therefore can suggest the use of PJ as an alternative to commercially available negative oral contrast agents in MRCP.

CONFLICT OF INTEREST

None

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None

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