STREAMLINED PANCREATIC CYST EVALUATION ON MRI-ABBREVIATED PROTOCOL (SPACEMAP): REDUCING WAITING TIMES IN A GENERAL HOSPITAL SETTING

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Purpose

Pancreatic cysts (PC) are common incidental findings picked up during routine Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) examinations. Many are not characterisable initially and need follow up. In some cases these may turn out to be malignant and early pick-up reduces morbidity and mortality.

Nonetheless, routine MRI follow up on standard MR abdomen protocols prove time-consuming and expensive, resulting in prolonged waiting times for MRI appointments. We aim to achieve a 50% reduction in MRI scan acquisition time for a patient attending for follow-up of a known pancreatic cystic lesion. The project will be implemented using the Plan-Do-Study-Act cycle within a six-month time frame.

Methods

The Quality Improvement project was carried out in Changi General Hospital's Radiology Department which houses over 1000 beds caring for a community of 1.4 million people in eastern Singapore. After evaluating the various factors possibly resulting in prolonged waiting times for outpatient MRI appointments, we decided to streamline our MRI scanning protocols for surveillance of pancreatic cystic lesions. (see Figure 1)

We conducted a qualitative study involving the body-imaging radiologists regarding what they felt were the most important imaging sequences for diagnosis in follow up of known pancreatic cysts. Several abbreviated MRI protocols for such clinical contexts were also obtained during literature review. We conducted a pilot study utlising retrospectively obtained scans performed for 30 consecutive patients who presented for PC follow up between January 2015 and July 2017. The scans were prepared into two sets, the first containing the full set of images, and in the second set only images in an abbreviated protocol were present.

Two junior attending radiologists then read the images from the two sets separately and scored the adequacy of images for diagnosis using a self-administered survey. They were also asked to rate the effectiveness of specific sequences in diagnosis within this clinical context. Findings from the qualitative survey were analysed using Statistical Package for Social Sciences (SPSS).

Results

All MRI examinations were performed on the Siemens MAGNETOM Aera (1.5 Tesla) machine.

Original full protocol (FP, see Figure 2A) included coronal T2 HASTE, axial T2 HASTE, axial T2 Fat-saturation (FS), axial T1 in-and-out of phase, axial diffusion-weighted imaging (DWI), pre-contrast axial VIBE, dynamic post-contrast axial VIBE, delayed post-contrast Axial VIBE, coronal SPACE 3D.

The short protocol (SP, see Figure 2B) omitted use of intravenous gadolinium-based contrast agent and consists only of axial T1 in-and-out of phase, coronal T2 HASTE, axial T2 HASTE, axial VIBE, coronal SPACE 3D sequences.

The abbreviated scan protocol omitted contrast-enhanced sequences and reduced overall scan times by 53.6%, from an average of 17 minutes and 22 seconds to 8 minutes and 3 seconds. Calculated potential cost savings may be up to S$372 per scan per patient. Using the FP, radiologists rated their confidence in verifying the scan at a mean score of 7.95 out of 9, while their diagnostic confidence average 7.67 on the short protocol (SP) with no statistically significant difference (t-test $p<0.05$). Radiologists deemed that the SP is sufficient in assessment of interval change with a median score of 8 (mean 7.92)

On an average, in 89.7% of cases a post-contrast T1 weighted sequence did not add value to the diagnosis in this clinical context, compared with 82.7% for volumetric T2-weighted MRCP sequence and 96.6% for T1 weighted in-and-out of phase sequences. No additional finding was detected in the omitted sequence that could not be detected in the SP.

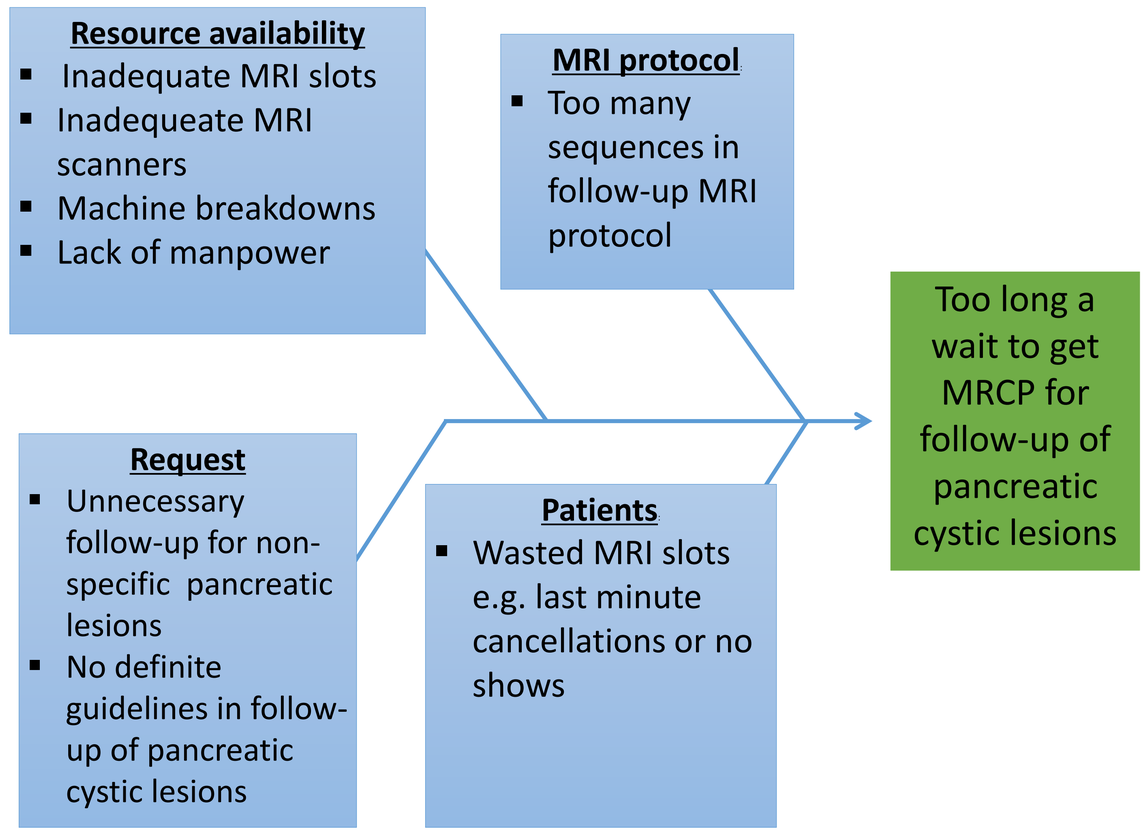

Figure 1. Root Cause Analysis of prolonged outpatient waiting time for follow up of pancreatic cystic lesions as presented in a Fishbone diagram

Original Full MRI Pancreas and MRCP Protocol

Sequences	Slices	Timing
Coronal T2 Haste	30	1:05
Axial T2 Haste	38	1:13
Axial T2 Fat Sat	38	2:15
Axial T1 In Out Phase	38	1:12
Axial Vibe	72	0:15
Test Bolus (Ranges from 20 to 35 seconds)	NA	0:35
Contrast administration (Ranges from 15 to 25 seconds)	NA	0:25
Axial Vibe Dynamic 3 passes	216	1:11
Axial DWI b50, 700 (Free breathing, duration varies with breathing pattern)	38	3:03
Coronal Space3D (Ranges from 4:18 to 5:03 depending on number of slices and breathing pattern)	88	5:03
Coronal thick slabs	8	0:50
Axial Vibe Delayed	72	0:15
Total scan duration		**17:22**

New Abbreviated MRI Pancreas (Follow-up) Protocol

Sequences	Slices	Timing
Axial T1 In Out Phase	38	1:12
Coronal T2 Haste	30	1:05
Axial T2 Haste	38	1:13
Axial Vibe	72	0:15
Coronal Space3D	72	4:18
Coronal thick slabs (done if 3D not optimal)	8	0:50
Total scan duration		**8:03 (to 8:53)**

Figure 2A (Left) Original full MRI Pancreas and MRCP Protocol; Figure 2B (Right) New abbreviated follow up protocol

Conclusion

The pilot study reveals that evaluation of known pancreatic cystic lesions can be adequately performed on a shortened MRI protocol with no statistically difference in the diagnostic confidence it accords radiologists. Benefits of a shortened protocol includes shortened scan times, reduced cost of examination and potentially improved patient safety as we have omitted the use of gadolinium-based contrast agent.

We have started the shortened protocol for routine examination in patients with known pancreatic cystic lesions and will continue to monitor the diagnostic accuracy and confidence it accords the reporting radiologists with regular audits.

We are also considering eliminating further sequences in the abbreviated follow up sequences, for example the Coronal Space3D sequence, which gives a three-dimensional cinematic overview of the pancreatic ducts but otherwise do not provide much information for this clinical setting.