Optimizing the Abdominal CT Oral Contrast Service in the Covid-19 Pandemic

Dr. Mary Renton, Dr. Ania Kielar, Daniel Toubassy, Mary May, Manjula Magnati, Corwin Burton & Dr. Satheesh Krishna

Joint Department of Medical Imaging, University of Toronto, Canada

Background

- During the Covid-19 pandemic it was difficult to maintain social distancing in outpatient (OP) waiting rooms, which put a vulnerable and often immunocompromised patient population at risk. This necessitated a reduction in patient waiting room exposure to minimize unnecessary potential viral transmission.

- At our institute, traditionally positive oral contrast was routinely used for OP abdominal CT and required a prolonged wait time in the department to allow for administration of oral contrast and adequate gastrointestinal transit time. This created a bottleneck in the patient pathway.

A large body of literature and international guidelines show that the use of oral contrast is not required for all abdominal CT studies and may have disadvantages, including:

- Unpleasant taste, aspiration, gastrointestinal symptoms
- Radiation increase (11% increase CT dose index volume)
- Beam-hardening artefacts
- Obscure mesenteric ischaemia, enteric mucosal disease and haemorrhage

Aims

Streamline	patient pathway by reducing waiting room times
Optimize	use of CT positive oral contrast
Improve	patient experience and cost effectiveness

Methods

A multidisciplinary stakeholder collaboration was utilized to implement the following interventions:

Intervention 1. *Oral contrast policy*

Departmental guidance to limit oral contrast use in the following indications:
- anastomotic leak/fistula
- peritoneal, ovarian and GI malignancies

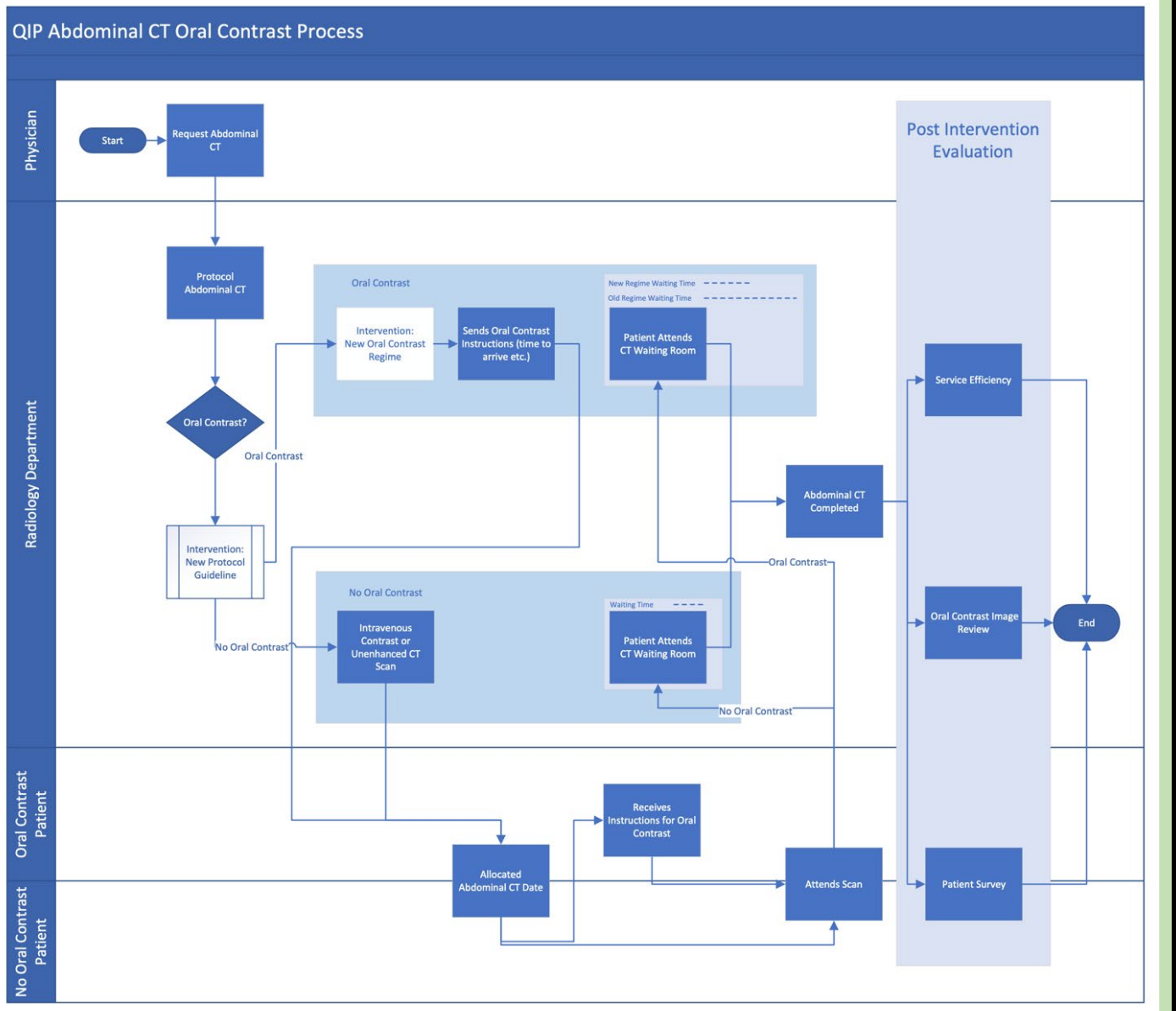
Intervention 2. *New, shorter oral contrast regime*

Old regime: Barium-based oral contrast (EZ-CAT 4.9 % w/v oral suspension), arrival time 60mins prior to scan

New regime: Water-soluble iodine based oral contrast (Telebrix®-Meglumine ioxitalamate), arrival time 30mins prior to scan

- Multicentre (3 teaching hospitals) retrospective service evaluation conducted over 1-month periods at baseline (pre-pandemic), baseline (pandemic) and post-intervention, to account for pandemic related variables. Data included:
  - Oral contrast use
  - Department wait time
  - Cost analysis
  - 8 months post-intervention, a follow up review was conducted on oral contrast use
- A voluntary patient survey was conducted to assess the patient experience of the outpatient CT service
- A randomized blinded image quality review of the oral contrast regimes was conducted by two abdominal Radiologists (49 old regime, 49 new regime). This checklist image review included diagnostic quality, contrast homogeneity, level of distal contrast and whether repeat imaging was required due to suboptimal diagnostic quality.

Implementing Change Management



Our interventions were implemented as per the process map.

The challenge of implementing change and new departmental policy was overcome by:

- ❑ Daily huddles and staff meetings
- ❑ Departmental Communications
- ❑ Collaboration with patient flow coordinators, administrative staff and Technologists
- ❑ Creation and dissemination of new patient information and instruction documents

Results

OP CTs baseline(pp) n =575, baseline (p) n=495 and post-intervention n=545

Oral contrast use (Intervention 1):

Reduction in oral contrast used, p<0.001

baseline(pp) 420- **73.0%,** baseline(p) 309- **62.4%** and post-intervention 178- **32.7%** reduction was sustained at the 8 month follow up with 430/1213, **35.4%**

Wait room times (Interventions 1&2):

Reduction in the patient wait room times, p<0.001

The wait room time was reduced by **15.3-15.8 minutes** per patient

Cost analysis (Intervention 1&2):

Reduction in cost, p<0.001

Monthly cost reduction of **69-78.4%,** $1196-1944 per month

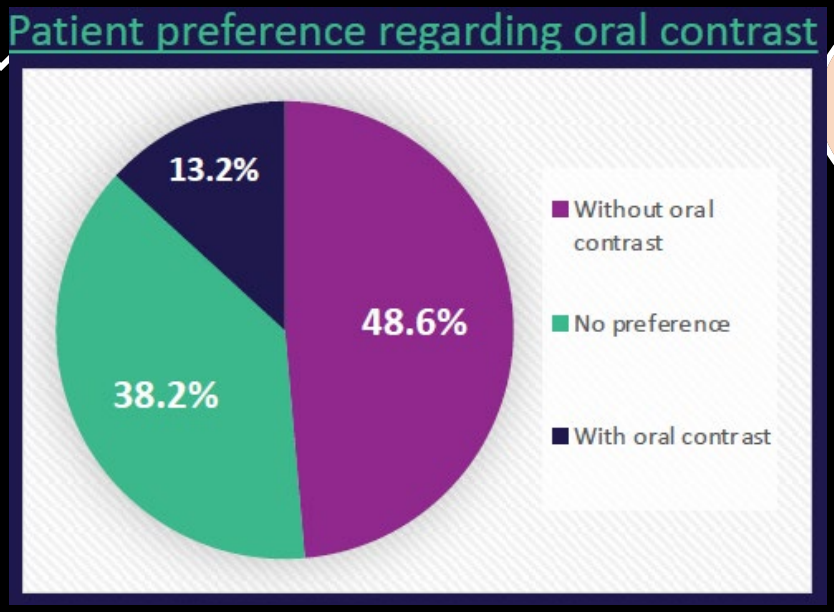
2-fold explanation: unit price reduced ($6 to $2.99) due to change to water-soluble contrast for new regime and the oral contrast use reduced

Results: Image Quality Review

Imaging Characteristic		Reviewer 1 (R1(			Reviewer 2 (R2)			Interrater reliability- Cohen's K (95% CI)
		Baseline	Post-intervention	P-value	Baseline	Post-intervention	P-value	
Distal contrast level	Small bowel	31 (63.3)	38 (77.6)	0.18	33 (67.3)	39 (79.6)	0.25	0.91(0.79-1.00)
	Large bowel	18 (36.7)	11 (22.4)		16 (32.7)	10 (20.4)		
Contrast density	Excellent	45 (91.8)	38 (77.6)	0.14	36 (73.5)	32 (64.0)	0.59	0.66(0.03-1.00)
	Adequate	3 (6.1)	9 (18.4)		11 (22.4)	15 (30.0)		
	Suboptimal	1 (2.0)	2 (4.1)		2 (4.1)	3 (6.0)		
Contrast homogeneity	Homogenous	34 (69.4)	29 (59.2)	0.40	31 (63.3)	18 (36.7)	0.02*	0.77(0.59-0.96)
	Inhomogenous	15 (30.6)	20 (40.8)		18 (36.7)	31 (63.3)		
Diagnostic Quality	Adequate	48 (98.0)	47 (95.9)	1.00	46 (93.9)	40 (80.0)	0.08	0.48(-0.11-1.00)
	Suboptimal	1 (2.0)	2 (4.1)		3 (6.1)	10 (20.0)		

- The diagnostic quality did not statistically differ between the old and new oral contrast regimes (Intervention 2, p=1.0, p=0.08)
- No repeat CTs were needed due to lack of oral contrast (Intervention 1) or poor opacification (Intervention 2).
- Contrast density was adequate/excellent for both readers in both groups, 94.9-96.9%
- No significant difference in contrast homogeneity between the two groups for R1; whereas, R2 noted a higher inhomogeneity in the postintervention group (63.3% vs.36.7%) (p=0.015). However, the diagnostic quality was preserved and was different between the two groups (R1 p=1.0, R2 p=0.08).
- Interrater reliability (Cohen's Kappa) for the categorical variable comparisons between reviewers ranged from moderate to almost perfect

Results: Patient Survey



- Total survey response **N=174**
- Response rate 15.7%

Questions	Survey responses, number responses (%)		
Adequate drinking time n=81	Yes	No	
	71 (94.7)	4 (5.3)	
Volume of contrast n=75	Fair	Too much	
	50 (61.7)	31 (38.3)	
Oral contrast taste n=98	Excellent/good	Tolerable	Bad/Terrible
	49 (50)	39 (39.8)	10 (10.2)
Side effects n=74	None	Mild	Moderate
	62 (83.8)	11 (14.9)	1 (1.3)
Preference for oral contrast n= 144	Without oral contrast	With oral contrast	No preference
	70 (48.6)	19 (13.2)	55 (38.2)

86.8% patients prefer without oral contrast or no preference

Overall experience: 97.7% having a similar or improved experience compared to previous

New contrast compared to old contrast (n=89):
83.1% similar or improved

94.7% had enough time to drink the new regime oral contrast

89.8% of patients reported the taste was good/tolerable

Discussion

Limitations

- Retrospective bias
- BMI was not assessed and patients with a low BMI may need oral contrast
- Survey: standard visibility English paper format-limiting accessibility and patients were reluctant to use paper forms during pandemic precautions

By optimizing CT oral contrast use our multistakeholder collaboration achieved:

- Reduced patient wait times, staff processing and administration
- Reduced costs
- Improved patient experience
- Maintained diagnostic quality imaging

Covid-19 pandemic has created an impetus and opportunity for collaborative radiology pandemic response initiatives to create sustained improvements to our services

Thank you for your attention