



Stable Trends in Radiation Exposure Amongst Patients with a New Diagnosis of Inflammatory Bowel Disease at an Irish Tertiary Referral Hospital

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Introduction

The utilisation of diagnostic imaging has risen dramatically over the course of the latter part of the 20th and early part of the 21st centuries.¹ Patients with inflammatory bowel disease are particularly vulnerable to this upward inclination.

Aims

We conducted a service evaluation analysing trends in the radiation doses to which our patients with new diagnoses of IBD were exposed over time.

Methods

Searches of new referrals to our IBD clinic, as a proxy for new diagnoses, during two 24-month periods beginning 01 June 2005 (n=84) and 01 January 2013 (n=63) respectively were conducted. We termed these respectively, the "Early Period" and the "Later Period".

Diagnosis of Crohn's disease, ulcerative colitis or indeterminate colitis was confirmed through review of associated letters, histology and radiology.

The numbers of abdominal radiographs, CTs of the abdomen and pelvis, barium swallows, meals, follow-throughs and enemas, CT colonographies and MRI small bowels were collated for each patient for the five-year period subsequent to their first attendance. The dataset was irrevocably anonymised.

Cumulative effective radiation doses (mSv) were calculated using estimates for each modality provided in leading radiology journals.²

2.47mSv

Mean Cumulative Effective Dose UC

8.25mSv

Mean Cumulative Effective Dose CD

Hypothesis statement construction was as follows.

The null hypothesis (H_0) was that first attendance in the later period was not correlated with an increased or decreased cumulative radiation exposure.

The alternate hypothesis (H_A) was that first attendance in the later period was correlated with an increased or decreased cumulative radiation exposure.

An equation (Eqn 1) was specified to test this hypothesis as illustrated below. It was controlled for age, gender and category of inflammatory bowel disease and estimated using ordinary least squares regression methodology.

$$DOSE_i = \alpha_0 + \alpha_1 AGE_i + \alpha_2 MALE_i + \alpha_3 LTRPERIOD_i + \alpha_4 CROHNS_i + \varepsilon_i$$

Where ε_i is a random disturbance term that is independently and identically distributed, α_0 , α_1 , α_2 , α_3 and α_4 are scalars,

$DOSE_i$ denotes the cumulative dose of radiation (mSv) to which patient i was exposed in the five years post their first clinic attendance, AGE_i denotes the age (years) of patient i at the time of their first clinic attendance, $MALE_i$ is a dummy variable which takes the value of 1 where patient i is male, $LTRPERIOD_i$ is a dummy variable which takes the value of 1 where patient i attended during the Later Period, $CROHNS_i$ is a dummy variable which take the value of 1 where patient i has a diagnosis of Crohn's disease.

Results

The mean cumulative effective radiation doses for the earlier and later periods were 4.7mSv (95% CI, 1.86 to 7.54) and 7.4mSv (95% CI, 3.60 to 11.26) respectively. The mean dose over both periods for UC and CD were 2.47mSv and 8.25 mSv respectively.

No significant relationship was demonstrated between age, male gender or later referral period and cumulative dose.

Variable	Coeff (mSv)	Std Error	Prob	95% Con Inter.
α_0	2.170	4.189	0.605	
AGE	-0.035	0.082	0.670	-0.20, 0.12
MALE	0.694	2.375	0.771	-4.00, 5.39
LTRPERIOD	3.058	2.393	0.203	-1.67, 7.78
CROHNS	5.887	2.437	0.017	1.07, 10.70
Observations	147			
Adjusted R2	0.053		Prob (F-Stat)	0.010

Table 2: Estimation output pertaining to equation 1

A diagnosis of Crohn's (as opposed to UC) had a strongly positive relationship with cumulative dose.

Accordingly, we were unable to reject the null hypothesis described above.

12 MRI small bowels were completed during period 2, none during period 1.

Conclusion

Our evaluation shows an upward trend, failing to meet statistical significance, in the radiation doses to which patients with new diagnoses of IBD were exposed by our service.

The use of magnetic resonance modalities increased significantly in the later period.

Patients with Crohn's disease had a significantly higher burden of radiation exposure than those with ulcerative colitis. This accords well with the literature.³

References

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