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Impact of Location on Radiation Exposure During ERCP: A Multi-Institutional Analysis at Tertiary Academic Centers

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Take Home Points

- The locations where a radiology tech performed fluoroscopy had a lower average radiation dose versus locations where the endoscopist controlled fluoroscopy
- Our analysis shows that the presence of a radiology tech had more of an impact on radiation exposure than endoscopist or patient comorbidities

INTRODUCTION

Radiation exposure is a hazard associated with performing ERCPs. ERCPs at our institution are performed in the operating room (OR), radiology suite, or endoscopy unit. The fluoroscopy device is either controlled by the endoscopist in the endoscopy unit or by a radiology technician (tech) in the OR or radiology suite. Our study examines the differences in radiation exposure between ERCPs performed in different locations.

METHODS AND MATERIALS

A retrospective cohort analysis was performed on adult ERCPs performed between 2015 to 2021. Cases with incomplete or undocumented fluoroscopy radiation exposure were excluded. Radiation dose (in mGy) was compared between the endoscopy unit and other settings (radiology suite, OR, and radiology suite and OR combined). Chi-square, Fisher exact test, and Student's t-tests were performed for descriptive analysis to report demographics and other health-related measurements. The multivariable regression models were adjusted for age at the time of the ERCP, race, gender, ethnicity, Charlson Comorbidity Index score (CCI), year of ERCP, and endoscopist. Multivariable logistic regression was adjusted for the same variables, with exception of the endoscopist.

RESULTS

Of 2211 ERCPs, 78.7% were performed in the endoscopy unit. The individuals in the OR and radiology suite had more comorbidities compared with those in the endoscopy suite (mean CCI=4.2 vs 3.6, p-value=0.0101). The average radiation dose was higher in the endoscopy unit setting (268.5) compared with the OR (78.7), radiology suite (145.8), and OR and radiology suite (131.1), adjusted p-value= 0.0044, 0.0488, 0.0021, respectively. 75% of cases were done by four endoscopists, who on average had less radiation dosage in the OR or radiology suite (54.2, 116.9, 58.9, 108.8), compared with the endoscopy unit (314.9, 216.9, 244.7, 243.5), with p-value=<0.0001, 0.0157, <0.0001, 0.0247, respectively. Individuals had an almost 4-fold chance to have a low radiation exposure (<75 mGy) when the exam was done in the OR or radiology suite compared to the endoscopy unit, OR 95% CI 3.6 [2.8-4.7].

Figure 1: Radiation amount during an ERCP in the endoscopy unit compared to the operating room or radiology unit from 2015 to 2021.

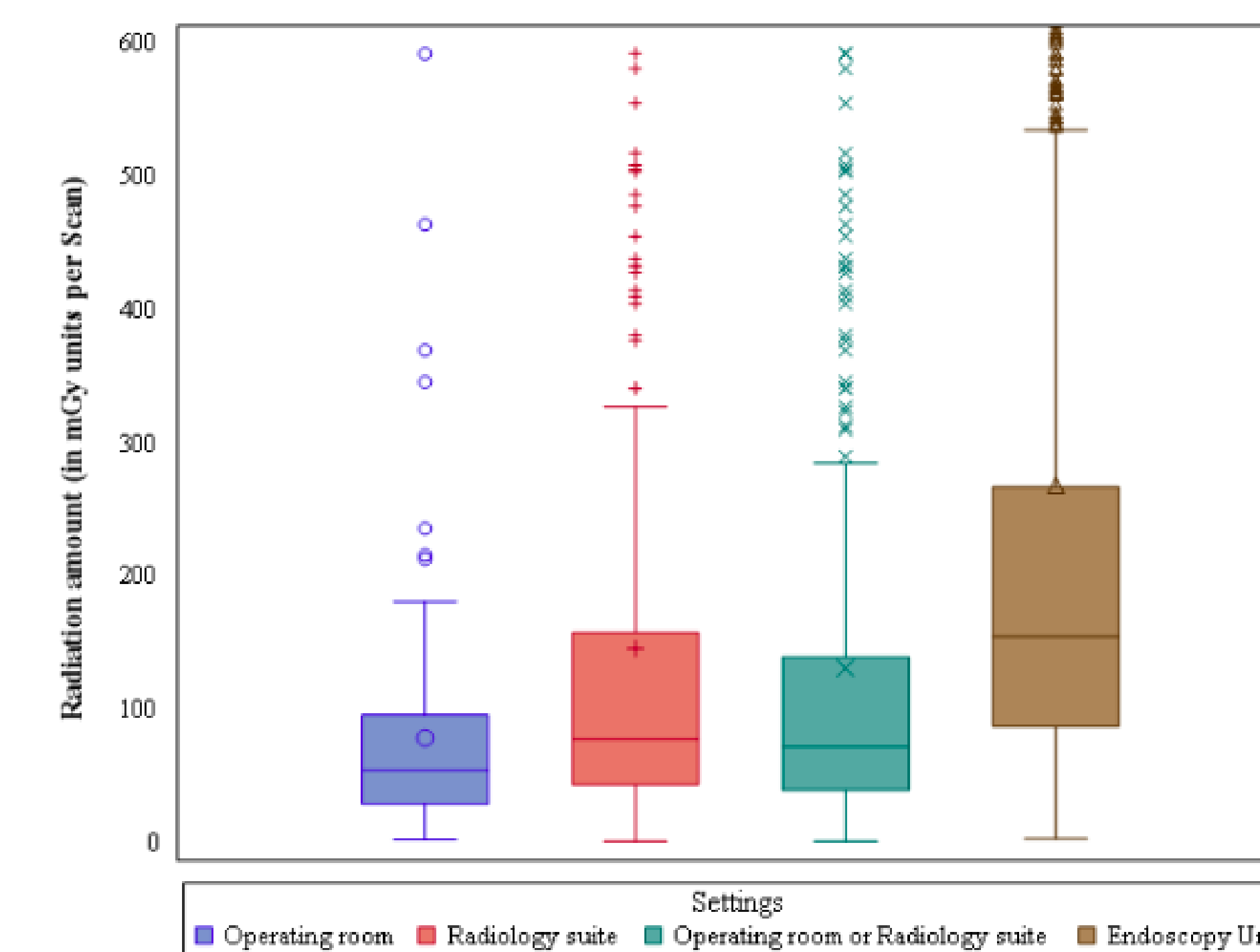


Figure 2: Radiation amount during an ERCP, by proceduralist, in the endoscopy unit compared with the operating room or radiology unit from 2015 to 2021.

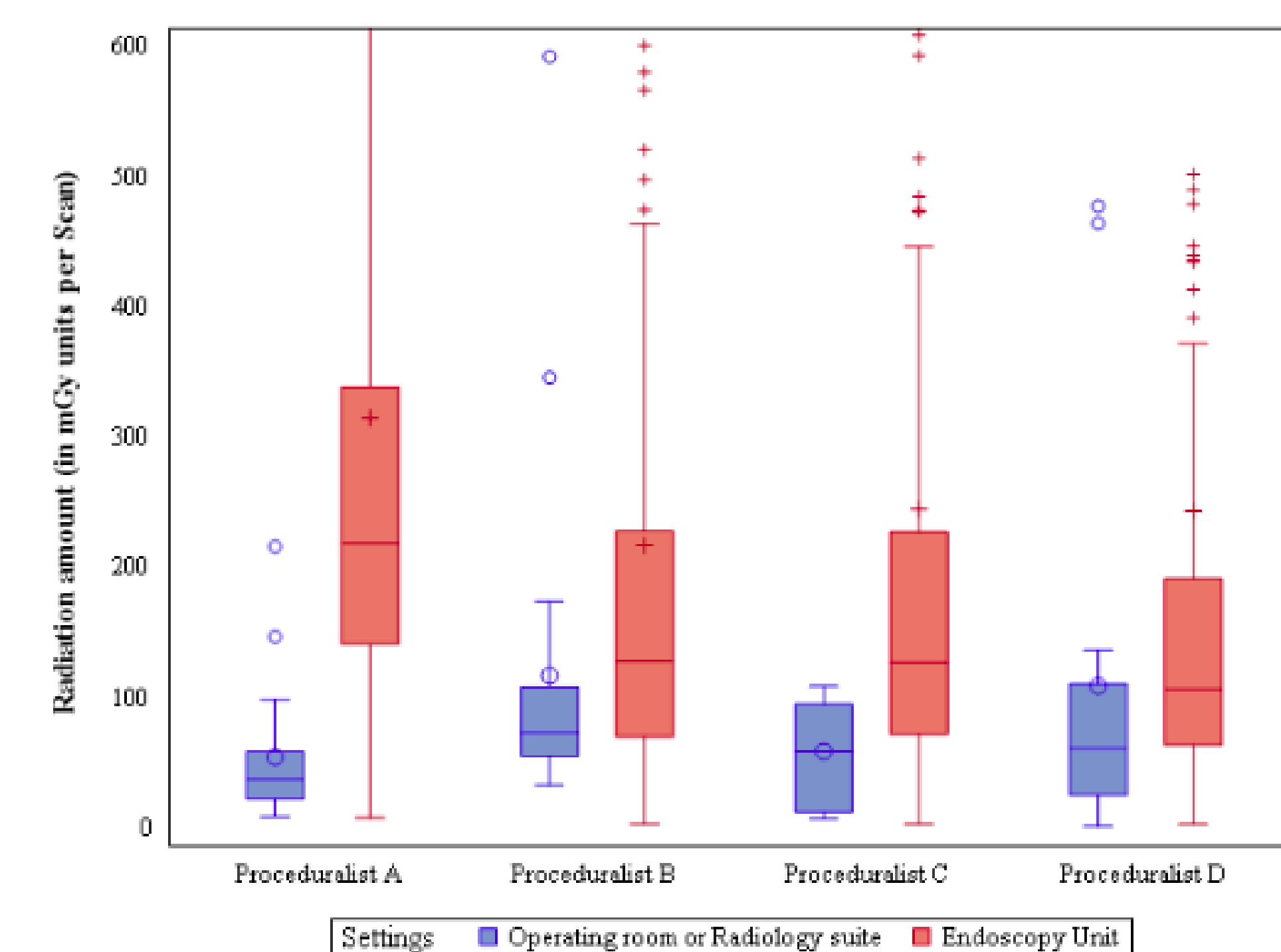


Figure 3: Radiation amount exposure categories during an ERCP, in the endoscopy unit compared with the operating room or radiology unit from 2015 to 2021.

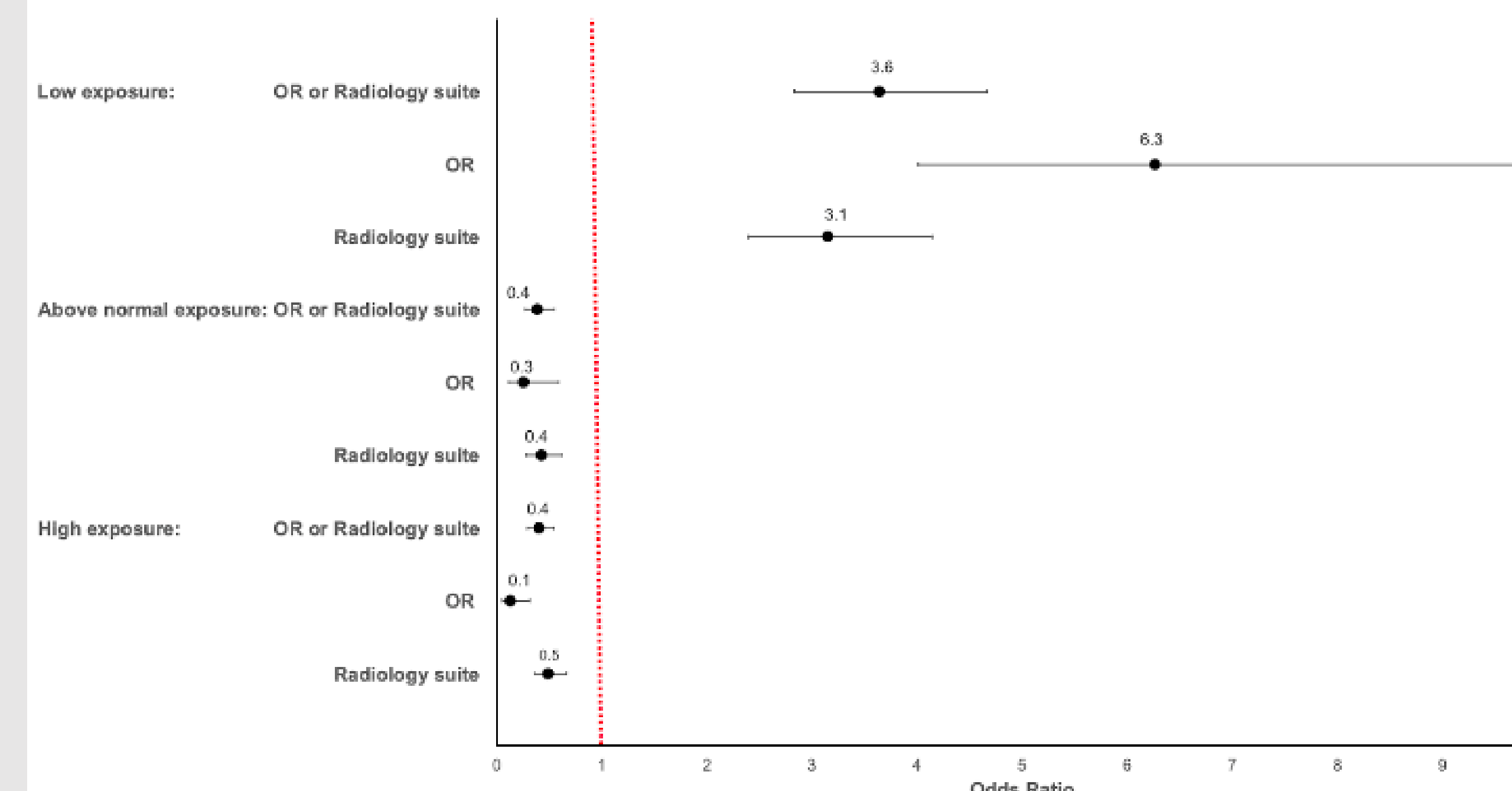


Table 1: Baseline characteristics of patients that had a ERCP in the endoscopy unit compared with the operating room or radiology unit from 2015 to 2021.

Patient encounter characteristics	Study groups						
	Endoscopy suite (n=1741, 78.7%)	OR (n=102, 4.6%)	P-value	Radiology Unit (n=368, 16.6)	P-value	OR or Radiology Unit (n=470, 21.3%)	P-value
Male gender, no. (%)	777 (44.6)	46 (45.1)	0.9263	143 (38.9)	0.0425	189 (40.2)	0.0867
White or Caucasian race, no. (%)	1277 (75.2)	73 (73.0)	0.2229	294 (80.6)	0.0908	367 (78.9)	0.1921
Hispanic or Latino	239 (14.2)	24 (24.0)	0.0070	46 (12.5)	0.4121	70 (15.0)	0.6538
Age at admission, mean (SD)	63.3 (18.6)	62.7 (18.5)	0.7551	66.2 (18.0)	0.0063	65.5 (18.1)	0.0227
Less than 50 years old	371 (21.3)	21 (20.6)	0.8626	64 (17.4)	0.0914	85 (18.1)	0.1252
50 - 65 years old	459 (26.4)	26 (25.5)	0.8455	73 (19.8)	0.0088	99 (21.1)	0.0189
65 - 75 years old	382 (21.9)	27 (26.5)	0.2847	92 (25.0)	0.2016	119 (25.3)	0.1206
75 - 85 years old	311 (17.9)	14 (13.7)	0.2865	78 (21.2)	0.1343	92 (19.6)	0.3938
More than 85 years old	218 (12.5)	14 (13.7)	0.7216	61 (16.6)	0.0370	75 (16.0)	0.0512
Hospital			<0.0001		<0.0001		<0.0001
# 1	1741 (100.0)	84 (82.4)		0 (0.0)		84 (17.9)	
# 2	0 (0.0)	18 (17.7)		368 (100.0)		386 (82.1)	
Proceduralist, no. (%)			<0.0001		<0.0001		<0.0001
A	607 (34.9)	16 (15.7)		3 (0.8)		19 (4.0)	
B	288 (16.5)	19 (18.6)		1 (0.3)		20 (4.3)	
C	316 (18.2)	8 (7.8)		3 (0.8)		11 (2.3)	
D	272 (15.6)	11 (10.8)		5 (1.4)		16 (3.4)	
E	35 (2.0)	12 (11.8)		149 (40.5)		161 (34.3)	
F	113 (6.5)	10 (9.8)		63 (17.1)		73 (15.5)	
Others*	110 (6.2)	26 (25.5)		144 (39.1)		170 (36.2)	
Number of ERCP	1.5 (1.1)	1.3 (0.8)	0.0800	1.4 (0.9)	0.3716	1.4 (0.9)	0.1505
CCI, mean (SD)	3.6 (3.5)	4.4 (3.6)	0.0439	4.1 (4.5)	0.0387	4.2 (4.4)	0.0101
CCI ≥ 2, no. (%)	1034 (59.4)	68 (66.7)	0.1452	229 (62.2)	0.3130	297 (63.2)	0.1353

DISCUSSION

One major factor differentiating ERCPs performed in the endoscopy unit versus those performed in the operating room is the presence of a radiology tech in the latter locations. Radiation exposure was higher in the endoscopy unit compared to both the radiology suite and OR. Subgroup analysis was performed for high-volume endoscopists performing the majority of ERCPs at our institution which confirmed the initial findings. Our results show that there are increased odds of having a relatively low radiation exposure (<75 mGy) in the OR or radiology suite, locations where a radiology tech performs fluoroscopy. Findings from this study suggest utilization of radiology techs should be considered to mitigate radiation exposure. Future studies are needed to examine the interaction of fluoroscopy time, radiation exposure, and outcomes of the ERCP, such as biliary ductal clearance.