patients who underwent invasive coronary catheterization. Independent, blinded QCA analysis was performed to determine presence of obstructive disease, defined by $\geq 50\%$ stenosis in 1 or more coronary vessels. The rate of disagreement was determined and cardiovascular event rates were compared between groups.

**RESULTS** A total of 929 (9.3%) patients had coronary angiograms with corresponding site reports; 591 patients had obstructive disease per site assessment, while 428 had obstructive disease per QCA (Table). The site read and QCA were different in 177 patients (disagreement rate 19.1%, simple $k=0.63$) of whom 171 had obstructive disease per site read but not by QCA. One-year event rates were highest (15%) when QCA and site assessment agreed for obstructive disease, lowest (2.4%) when QCA and site agreed for no obstructive disease, and intermediate (7.1%) when disagreement existed between QCA and site reads (Figure).

<table>
<thead>
<tr>
<th></th>
<th>CAD &gt; 50%</th>
<th>1 Year K-M Event Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QCA +</td>
<td>QCA -</td>
</tr>
<tr>
<td>Site +</td>
<td>422</td>
<td>171</td>
</tr>
<tr>
<td>Site -</td>
<td>6</td>
<td>330</td>
</tr>
<tr>
<td>TOTALS</td>
<td>428</td>
<td>501</td>
</tr>
</tbody>
</table>

*Given the low number of patients with Site - and QCA + (6), no Kaplan-Meier rates were reported or graphed.

**CONCLUSIONS** Routine visual estimation of angiograms overestimates obstructive disease compared to QCA. Site and QCA agreement on CAD $>50\%$ or $<50\%$ was associated with high and low event rates, respectively; disagreement was associated with intermediate rates. These findings suggest that opportunities exist to improve the assessment of coronary angiography.

**CATEGORIES CORONARY:** Angiography and QCA

**KEYWORDS** Angiography, Coronary artery disease, Quantitative coronary angiography

**TCT-285**

Radiation dose reduction in the cardiac catheterization laboratory utilising a novel protocol

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**BACKGROUND** The cardiac catheterization laboratory is an important source of radiation. A reduction in radiation doses as low as possible, maintaining the quality of procedures is essential. Our aim was to analyze the results of a novel radiation reduction protocol (RRP) system for coronary angiography and interventional procedures and the determinants of radiation dose.

**METHODS** 1130 consecutive procedures from a single catheterization laboratory [diagnostic coronary angiographies (CA) and percutaneous coronary interventions (PCI)] were analyzed. 359 were performed before RRP and 591 after it. RRP implementation consisted in reducing the number of ventriculographies and aortographies for cases with a clear indication, reducing number of cine runs, and using as much as possible low resolution fluoroscopy and last fluoroscopy hold (a software program that enables dynamic storage of last fluoroscopy sequences).

**RESULTS** 69.4% were male with a mean age of 66.8 ± 12.6 years. There were no significant differences in clinical baseline features nor in the percentage of PCIs performed during the 2 periods (54.9% vs 52.6%; $p=0.5$). They had a similar complexity: syntax score $(18.1 \pm 12.2$ vs 18.8 $\pm 14$; $p=0.7$); acute coronary syndromes (45.5% vs 44.4%; $p=0.7$); bifurcations (26.4% vs 29.8%; $p=0.13$) apart from a higher proportion of total chronic obstructions performed after the RRP implementation (8.6% vs 13.3%; $p=0.001$). The angiographic success was similar in both periods (98.3% vs 99.2%; $p=0.6$). After the implementation of RRP, there were no significant differences in median fluoroscopy time (12.7 vs 13.6 min; $p=0.1$) and duration of procedures (25.5 vs 30.4 min; $p=0.14$). A significant reduction of the percentage of procedures with ventriculography (83.6% vs 12.3%; $p<0.0001$) or aortography (17.7% vs 6.1%; $p<0.0001$) was observed, as well as a significant reduction in cine runs (21.1 vs 7.1; $p<0.0001$) and dose-area product (DAP) (156 vs 71 Gyxcm2; $p<0.0001$).

**CONCLUSIONS** With the implementation of a RRP, a highly significant 54.5% reduction of DAP was observed without a reduction in the quality or the complexity of procedures. A RRP should be strongly considered among interventional cardiology practice.

**CATEGORIES CORONARY: Complications**

**TCT-286**

Strategy to reduce radiation dose in cardiac catheterization laboratory- a phantom based study

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**BACKGROUND** Utilizing lower frame/pulse rates (fluoroscopy) is generally considered to reduce the radiation to the patient. However, there is little data on the impact of using lower pulse rate (cine) on total radiation dose. In a phantom-model study, we sought to assess the impact of lower frame/pulse rate and change in intensifier angulation on radiation dose to the patient.

**METHODS** A commercially available adult thoracic anthropomorphic phantom (Lungman4, Kyoto Kakagu, Kyoto, Japan) was used to determine the dose to various organs as shown in Figure 1. Standard angulations (6 views with 300 and 6 views with 40 0) using cine acquisitions (10 seconds for each acquisition) and similarly fluoroscopy using 30 0 angulations (20 seconds for each run) were chosen to expose the phantom. A sheet ($12\times 8\"$) of radiographic dosimetry film (Gafchromic® XR-QA) was used to determine the position of maximum skin exposure. Strips ($1\times 2\") of radiographic films attached to phantom at positions 1 to 6 (Figure 1). The radiographic strips were changed after every complete cine or fluoroscopy run (with 6 acquisitions in each run). Dose was estimated from the radiographic strips using dose/intensity calibration curves. Dose-Area product was measured from the X-ray equipment system (using an in-built ionization chamber placed in the X-ray tube assembly) for all patients.
RESULTS Fluoroscopy data: Dose-area product (DAP) was significantly lower in the low frame rate groups (7.5 frames / sec (FPS)) compared to standard practice of 15 FPS (294 vs 500 cGy.cm2). Cine angiography data: DAP was lower in the low pulse rate group (10 pulse/sec) compared to standard pulse rate cine angiography (15 pulse/sec) (1185 vs. 2111 cGy.cm2). Radiation dose was lower in low pulse group as compared to standard group (25.3 vs 16.3 mGy in Cine angiography and 3.3 vs 5.4 mGy in fluoroscopy). Similar reduction in estimated radiation doses were noted at all the sites as shown in Figure 1. We also found that steep angulation (40°) also contributed to a significant increase in radiation dose in comparison to 90° angulations across all groups (low BMI: 1522 vs. 1299; normal BMI: 3289 vs. 2111; and large BMI: 4506 vs. 2852 cGy.cm2). CONCLUSIONS Lowering frame/pulse rate resulted in radiation dose reduction in our phantom study. Such changes should be implemented in routine catheter laboratory practice.

CATEGORIES CORONARY: Angiography and QCA

KEYWORDS Frame count, Radiation dose