Financial analysis of transitioning interventional procedures from Computed Tomography rooms to a contemporary AngioInterventional suite

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Financial Disclosures

• Charles Martin III, MD serves on the Interventional Oncology Scientific Advisory Board for Boston Scientific corporation.
• Catherine Polito, MS3, Carl Creagh, Vincent Saccardi : Nothing to disclose
• Aya Rebet is a GE Healthcare employee
Objective

To evaluate the economic factors associated with moving procedures from a conventional Computed Tomography (CT) room to an Interventional Radiology (IR) suite.

• Increasing accessibility to diagnostic CT
• Maintaining clinical workflow of procedures
Summary

- Procedures performed in our CT suites were analyzed. Procedures classified as transferrable to an IR suite with no suspected clinical impact represented ~1600 hours of room occupation / year.

- Transferring these procedures from CT suites, where they are currently performed, to IR suites would increase our annual balance by 1.2-1.5 million dollars on average, maintaining clinical workflow while increasing accessibility to diagnostic CT.

<table>
<thead>
<tr>
<th>Annual Increase</th>
<th>Medicare</th>
<th>125% Medicare</th>
<th>150% Medicare</th>
<th>175% Medicare</th>
<th>200% Medicare</th>
</tr>
</thead>
<tbody>
<tr>
<td>$649,042</td>
<td>$951,535</td>
<td>$1,254,027</td>
<td>$1,556,519</td>
<td>$1,859,011</td>
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</tr>
</tbody>
</table>

- Some of these transferrable procedures could be facilitated by the advanced guidance tools available in our new angiography suite (Discovery IGS740, GE Healthcare).
Methods

• Retrospective analysis of all procedures performed in our CT suites from 01/01/2016 to 03/01/2016.
• IRB-approved, HIPAA-compliant

• Procedures classified by type and categorized by experienced HCP as transferrable to IR suite with no suspected clinical impact, or non-transferrable due to potential clinical impact.
• “Potential clinical impact” was defined as any procedure that would best be performed with the assistance of live diagnostic CT imaging (with or without contrast) compared to Cone Beam CT, in terms of image quality or coverage size.

• Cost-value analysis simulated moving all transferrable procedures to our new IR suite and using the freed time for diagnostic CT scans.
Study financial model

• Reimbursement model:
  p% * Medicare reimbursement rate, with p% typically varying from 100% to 200%

Medicare reimbursement (Med$) for procedures and scans performed at our institution:

Med$ = professional component + technical component

Professional component rates fixed by Medicare Physician Fee Schedule = CF * (wRVU * wGPCI + pERVU * pEGPCI + mPRVU * mGPCI)

CF: Conversion Factor, RVU: Relative Value Units, GPCI: Geographic Practice Cost Index

Technical component rates fixed by Medicare Ambulatory Payment Classification (APC) Fee Schedule = National APC rate * Geographic wage index

• Institutional Margin (IM) per procedure/scan:

IM_{procedure/scan} = (p% * Med$_{procedure/scan}$ - cost_{staff (physician, nurse(s), tech(s))} - cost_{admin staff} - cost_{IR/CT room} - cost_{facilities}) + (p% * Med$ - cost)_{IR supplies, pharmaceuticals & contrast}

• Additional IM induced by transferring N hours of procedures performed under CT to IR:

AddIM = p% * Med$_{additional CT scans on N hours}$ - cost_{IR staff (techs, nurses) for N hours} + cost_{CT procedures staff (techs, nurses) for N hours} - cost_{CT scans reading physician} - cost_{CT scans staff (techs, nurses) for N hours} - cost_{IR room for N hours}
Results

- 336 procedures performed in our CT rooms from 01/01/2016 to 03/01/2016  
  = 637 hours of room occupation
- 205 procedures (61% of total procedures) classified as transferrable with no suspected clinical impact:  
  = 408 hours of room occupation (quarterly)
- Moving the transferrable procedures to IR and using the 1632 freed hours (annual) in CT for additional diagnostic scans results in an increase in cost realization of:

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- These amounts are not specific to our institution: any institution transferring N hours of procedures from CT to IR and performing diagnostic CTs instead, would increase their annual balance by (N/1632 * previous amounts).
## Analysis of Procedures performed in CT:

<table>
<thead>
<tr>
<th>Procedures classified as transferrable</th>
<th>Number of Procedures</th>
<th>CT room occupation (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT guided percutaneous abscess drainage</td>
<td>113</td>
<td>11383</td>
</tr>
<tr>
<td>Bone biopsy/ablation</td>
<td>32</td>
<td>2146</td>
</tr>
<tr>
<td>Bone marrow biopsy</td>
<td>20</td>
<td>1162</td>
</tr>
<tr>
<td>Liver biopsy/ablation</td>
<td>14</td>
<td>1311</td>
</tr>
<tr>
<td>Kidney biopsy/ablation</td>
<td>11</td>
<td>1286</td>
</tr>
<tr>
<td>US guided procedure</td>
<td>8</td>
<td>542</td>
</tr>
<tr>
<td>Drain placement/exchange</td>
<td>4</td>
<td>287</td>
</tr>
<tr>
<td>Superficial lymph node biopsy</td>
<td>2</td>
<td>151</td>
</tr>
<tr>
<td>Catheter removal</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>205</strong></td>
<td><strong>18328</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedures classified as non transferrable</th>
<th>Number of Procedures</th>
<th>CT room occupation (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung biopsy</td>
<td>61</td>
<td>4440</td>
</tr>
<tr>
<td>Retroperitoneal (except kidney) biopsy</td>
<td>29</td>
<td>2138</td>
</tr>
<tr>
<td>Pelvic biopsy</td>
<td>10</td>
<td>752</td>
</tr>
<tr>
<td>Axillary mass biopsy adjacent to critical structures</td>
<td>6</td>
<td>438</td>
</tr>
<tr>
<td>Paraspinal mass biopsy</td>
<td>5</td>
<td>439</td>
</tr>
<tr>
<td>Soft tissue biopsy</td>
<td>5</td>
<td>310</td>
</tr>
<tr>
<td>Vertebral disc aspiration</td>
<td>5</td>
<td>332</td>
</tr>
<tr>
<td>Abdominal drainage</td>
<td>3</td>
<td>318</td>
</tr>
<tr>
<td>Chest wall biopsy</td>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td>Intraperitoneal (except liver) biopsy</td>
<td>2</td>
<td>111</td>
</tr>
<tr>
<td>Joint biopsy</td>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td>Mediastinal biopsy</td>
<td>2</td>
<td>151</td>
</tr>
<tr>
<td>Nerve block</td>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>134</strong></td>
<td><strong>9788</strong></td>
</tr>
</tbody>
</table>
Benefits of modern angio-interventional suites

- Advanced features available in our modern angiography suite include multimodality fusion, trajectory planning, needle guidance, 3D-fluoroscopy overlay and Stereo3D (GE Healthcare). These advanced features can bring value to the transferred procedures: improving clinical workflow, decreasing time, patient exposure and contrast levels, as well as improve safety and flexibility in out-of-plane access:

Pleural based mass (a,b). Trajectory of the biopsy needle is planned on CBCT (c,d). Needle guided using low dose fluoroscopy overlaid on 3D plan (e,f). Needle position reconstructed in the 3D anatomy using three fluoro views only, instead of a full CBCT (Stereo3D, GE Healthcare) (g,h).

(Needle ASSIST Solutions, Discovery IGS740, GE Healthcare).
Benefits of modern angio-interventional suites

Liver tumor ablation – Probe trajectory planned on CBCT fused on CT (a) and PET (g). Probe guided using the automatically generated Bulls Eye and Progress views (b,c), overlaying live low dose fluoroscopy on our 3D plan (h,i). Probe position verified by reconstruction in the 3D anatomy using three fluoro views only, instead of a full CBCT (d,e). Assessment of lesion coverage by ablation area by fusing pre-ablation CT with post ablation CBCT (f) and pre-ablation PET with post ablation CBCT (j). (Needle ASSIST Solutions, Discovery IGS740, GE Healthcare).
Study hypotheses

This financial analysis assumed:

- An IR department capable of extra capacity (performing ~2-3 extra procedures/day)
- Sufficient diagnostic CT scan demand to fully utilize the freed hours in the CT suites from procedure transfer
- Equivalent use of contrast, pharmaceuticals and disposable supplies between procedures performed in CT & IR
- Procedure time obtained from patient medical record, with additional 30min turnaround time.
- Equivalent time to perform a transferrable procedure between CT and IR.
- Outpatient reimbursement Medicare rates only. No fee reduction for multiple same day procedures.
- National averages for staff salaries
- Additional CT capability assigned to scans according to CT scans distribution at our institution from 01/01/2016 to 03/01/2016, with average reading time as follows:

<table>
<thead>
<tr>
<th>Scan Type</th>
<th>CPT Code</th>
<th>Number of additional scans possible / year</th>
<th>tMed$ ($</th>
<th>pMed$ ($</th>
<th>Med$ ($</th>
<th>Avg reading time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT brain without contrast</td>
<td>70450</td>
<td>330.5</td>
<td>107.66</td>
<td>42.73</td>
<td>150.39</td>
<td>5</td>
</tr>
<tr>
<td>CT chest without IVCON</td>
<td>71250</td>
<td>293.7</td>
<td>107.66</td>
<td>51.14</td>
<td>158.8</td>
<td>17</td>
</tr>
<tr>
<td>CT chest with contrast</td>
<td>71260</td>
<td>189.7</td>
<td>226.68</td>
<td>62.33</td>
<td>289.01</td>
<td>17</td>
</tr>
<tr>
<td>CT abdomen pelvis with contrast</td>
<td>74177</td>
<td>263.1</td>
<td>332.78</td>
<td>91.07</td>
<td>423.85</td>
<td>17</td>
</tr>
<tr>
<td>CT abdomen pelvis wo contrast</td>
<td>74176</td>
<td>146.9</td>
<td>183.72</td>
<td>87.22</td>
<td>270.94</td>
<td>17</td>
</tr>
</tbody>
</table>
Study limitations

• The validity of our financial analysis relies on multiple hypotheses:
  • In particular, it is not applicable to institutions with insufficient diagnostic CT demand
  • Technical feasibility and our time equivalence hypothesis could be validated in the next phase of the study, by transferring some of these procedures to our new IR suite, and assessing its impact on safety, efficiency, clinical workflow, patient dose, contrast, and procedure time.

• Results presented do not include adjustments introduced by MACRA. Main impact in 2019 will be a -4% to +12% adjustment of Medicare professional component, depending on the provider’s ratings, inducing adjustments on the results as follows:

<table>
<thead>
<tr>
<th>No MACRA adjustment</th>
<th>Increase in annual balance</th>
<th>Medicare</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MACRA -4%</td>
<td>Increase in annual balance</td>
<td>$636 604</td>
<td>$935 987</td>
<td>$1 235 369</td>
<td>$1 534 752</td>
<td>$1 834 135</td>
</tr>
<tr>
<td>MACRA +12%</td>
<td>Increase in annual balance</td>
<td>$686 358</td>
<td>$998 179</td>
<td>$1 310 000</td>
<td>$1 621 821</td>
<td>$1 933 642</td>
</tr>
</tbody>
</table>
Thank you!