AI for Polyp Detection

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COI

➢ Olympus Corp. (consulting and speaking honorarium)
➢ Cybernet Corp. (ownership interest)
Three roles of AI in colonoscopy

1. Computer-aided detection (CADe)

2. Computer-aided diagnosis (CADx)

3. Computer-aided quality assurance (CAQ)
6 RCTs

Increased ADR: 1.47 risk ratio

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>CAD Events</th>
<th>CAD Total</th>
<th>WL Events</th>
<th>WL Total</th>
<th>Weight M-H, Random, 95% CI</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gong et al., 2020</td>
<td>54</td>
<td>324</td>
<td>26</td>
<td>318</td>
<td>6.6%</td>
<td>2.04 [1.31, 3.17]</td>
</tr>
<tr>
<td>Su et al., 2020</td>
<td>89</td>
<td>308</td>
<td>52</td>
<td>315</td>
<td>11.7%</td>
<td>1.75 [1.29, 2.37]</td>
</tr>
<tr>
<td>Wang et al., 2019</td>
<td>151</td>
<td>522</td>
<td>109</td>
<td>536</td>
<td>17.9%</td>
<td>1.42 [1.15, 1.76]</td>
</tr>
<tr>
<td>Wang et al., 2020</td>
<td>165</td>
<td>484</td>
<td>134</td>
<td>478</td>
<td>20.2%</td>
<td>1.22 [1.01, 1.47]</td>
</tr>
<tr>
<td>Liu et al., 2020</td>
<td>198</td>
<td>508</td>
<td>124</td>
<td>518</td>
<td>20.4%</td>
<td>1.04 [1.06, 1.97]</td>
</tr>
<tr>
<td>Repici et al., 2020</td>
<td>187</td>
<td>341</td>
<td>138</td>
<td>344</td>
<td>23.2%</td>
<td>1.36 [1.16, 1.60]</td>
</tr>
</tbody>
</table>

**Total (95% CI)**

<table>
<thead>
<tr>
<th></th>
<th>CAD</th>
<th>WL</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events</td>
<td>2497</td>
<td>2509</td>
<td>1.47 [1.30, 1.67]</td>
</tr>
<tr>
<td>Heterogeneity</td>
<td>Tau²=0.01</td>
<td>Ch²=9.41, df=5 (P=0.09); I²=47%</td>
<td></td>
</tr>
<tr>
<td>Test for overall effect</td>
<td>Z=6.04 (P &lt; 0.00001)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ADR: 25% -> 37%
Does truly AI increase advance adenoma detection?

Hassan C, et al. GIE 2020
Advanced adenomas missed by human but detected by AI

CASE 1

CASE 2

Kamba S, et al. J Gastroenterol 2021
Role of artificial intelligence in detection and characterization of colorectal polyps

**RECOMMENDATION**

**2019 statement:**
ESGE suggests the possible incorporation of computer-aided diagnosis (detection and characterization of lesions) into colonoscopy, if acceptable and reproducible accuracy for colorectal neoplasia is demonstrated in high quality multicenter in vivo clinical studies. Possible significant risks with implementation, specifically endoscopist deskilling and over-reliance on artificial intelligence (AI), unrepresentative training datasets, and hacking, need be considered.*

*Weak recommendation, low quality evidence.*

1. Unknown performance in CRC screening
2. Unknown cancer prevention effect
3. Unknown cost-effectiveness
KNOWLEDGE GAPS!!

1. Unknown performance in CRC screening
2. Unknown cancer prevention effect
3. Unknown cost-effectiveness
Performance of CADe in cancer screening programme

Screening colonoscopy:  No data

F/U colonoscopy after FIT-positive:  Only sub-analysis data*

*N=207 (ADR 44% ->60%); Repici, et al. Gastroenterology 2020
KNOWLEDGE GAPS!!

1. Unknown performance in CRC screening
2. Unknown cancer prevention effect
3. Unknown cost-effectiveness
Assumptions: every-10-year screening colonoscopy (60% compliance) between 50 and 80 years old in the US.

<table>
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<tr>
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<th>Colonoscopy without CADe</th>
<th>Colonoscopy with CADe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal cancer incidence (vs. no screening)</td>
<td>56%</td>
<td>51%</td>
</tr>
</tbody>
</table>

-5%
Real-world data

10-year Follow up

CRC incidence

Colonoscopy without AI
Colonoscopy with AI
KNOWLEDGE GAPS!!

1. Unknown performance in CRC screening
2. Unknown cancer prevention effect
3. Unknown cost-effectiveness
Cost-effectiveness of AI in colonoscopy

AI detects more polyps

More polypectomies

COST
**Increased frequency of intensive surveillance:**

1.35 risk ratio

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Control</th>
<th>Risk Ratio with 95% CI</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang P, et al. 2019</td>
<td>Yes 43</td>
<td>No 479</td>
<td>2.01 [1.22, 3.31]</td>
<td>8.91</td>
</tr>
<tr>
<td>Wang P, et al. 2020</td>
<td>Yes 39</td>
<td>No 445</td>
<td>1.43 [0.89, 2.29]</td>
<td>11.15</td>
</tr>
<tr>
<td>Liu P, et al. 2020</td>
<td>Yes 20</td>
<td>No 373</td>
<td>1.55 [0.78, 3.08]</td>
<td>5.31</td>
</tr>
<tr>
<td>Repici A, et al. 2021</td>
<td>Yes 84</td>
<td>No 246</td>
<td>1.27 [0.96, 1.69]</td>
<td>27.09</td>
</tr>
<tr>
<td>Wang P, 2020</td>
<td>Yes 12</td>
<td>No 372</td>
<td>0.80 [0.39, 1.67]</td>
<td>6.14</td>
</tr>
<tr>
<td>Kamba S, et al. 2021</td>
<td>Yes 33</td>
<td>No 139</td>
<td>0.95 [0.62, 1.46]</td>
<td>14.28</td>
</tr>
</tbody>
</table>

**Overall**

1.35 [1.16, 1.57]

Heterogeneity: I² = 29.02%, H² = 1.41
Test of θ = 6; Q(8) = 11.27, p = 0.19
Test of θ = 0; z = 3.83, p = 0.00

Fixed-effects Mantel-Haenszel model
More polypectomies

AI detects more polyps
More polypectomies

AI increases ADR
Cancer prevention

Cost-effectiveness of AI in colonoscopy
Assumptions: every-10-year screening colonoscopy (60% compliance) between 50 and 80 years old in the US.

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<td>51%</td>
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<tr>
<td>(vs. no screening)</td>
<td>$3,400</td>
<td>$3,343</td>
</tr>
<tr>
<td>Cost per person (mean)</td>
<td></td>
<td>-$57</td>
</tr>
</tbody>
</table>

Areia M - Mori Y, Hassan C, et al. submitted
-Take Home Messages-

➢ AI is expected to improve CRC screening programmes.

➢ High-quality evidence is needed to implement AI in the CRC screening.