Advances in Colorectal Cancers Screening and Surveillance

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Epidemiology

1,800,000 new cases in 2018
861,000 deaths

Significant morbidity and mortality
Health care costs

Population is aging
Screening is effective

SEER data 2017
Work yet to be done

Increase number of patients screened
Decrease barriers of screening
Decrease number of new cancer diagnoses
Decrease number of interval colon cancer
Questions to answer today

What age to start screening?

What age to stop screening (and surveillance)?

Adherence to surveillance

Techniques to improve screening

Artificial intelligence
Colon Cancer Screening Guidelines

http://gi.org/guideline/colorectal-cancer-screening/

- Colonoscopy age 50
  - Average risk individuals without a family history of colon cancer

- Colonoscopy age 45
  - Average risk African Americans without a family history of colon cancer

- Patients who refuse a colonoscopy
  - FIT test, stool DNA
  - CT colonography
  - Flexible sigmoidoscopy and barium enema
CRC Incidence by Age

Robertson, Ladabaum; Gastroenterol 2019; 156:904-17
Early CRC Screening: Life Years Gained

Figure 5. Model-estimated Life Years Gained from CRC Screening Starting at Aged 45y vs 50y, per 1000 Screened Over a Lifetime

Screen 45-75 vs. 50-75 years:
- +6.2% Life years gained
- 17% more colonoscopies

CA Cancer J Clin 2018; doi 10.3322/caac.21457
Age 45 Screening is cost effective

Cost –Effectiveness and National Impact of Initiating Average Risk CRC Screening at 45 Instead of 50: Implications of the new ACS Recommendations

- Averted 4 cancers
- Gained 14.4 years/1000 patients
- 758 additional colonoscopies
- Cost $33,900

Ladabaum, et al. Presentation 985
Age 45 Screening is cost effective

American Cancer Society
- 45-75: Averted 37 cases/1000 patients
- 50-75: Averted 36 cases/1000 patients

- 45-75: Averted 23 deaths/1000
- 50-75: Averted 22 deaths/1000
American Cancer Society (ACS) Analysis: Years lost due to CRC

B. Distribution (%) of person-years of life lost due to CRC by age at diagnosis

CA Cancer J Clin 2018; doi 10.3322/caac.21457
Age 45 Screening is cost effective

Does Adenoma Detection Rate at Different Intervals of Age Support Recommendations to Start Colorectal Screening at 45?

- 2665 examination
- ADR similar between 45-49 and 50-55
- Supports screening at 45

Gutierrez et al: Su 1743
Early Onset Colon Cancer

Comparison of Presenting Diagnoses: Symptoms in Patients with Young vs. Older Onset Colorectal Cancer

• 16,266 younger vs 115,833 older (>50)
• Bleeding, Change in bowel habits, abdominal pain

Pay attention to patient complaints, and have a low threshold to advise a colonoscopy

Vajravely et al: Mo 1708
Early Onset Colon Cancer

Genetic characteristics:
• N=430; 111 had (+) First degree relative
• 20% (n=85) had germline mutation
• Of those 85, only ½ had (+) first degree relative

Advanced stage upon detection

Location: Distal > proximal

Ethnicity Matters

Stoffel et al. Gastro 2018: 154(4) 897-907
Screening and Management of Lynch Syndrome in Clinical Practice

- Assumption: Colon cancer in patients < 70 reflexively get MMR-IHC or MSI evaluation
- < 40% screened CRC for Lynch Syndrome
- 83% had access to hereditary cancer clinic

*Lynch Syndrome underrecognized*
*Missed opportunities to identify potential young patients for screening*

Jain et al. Mon 1633
Early Onset Colon Cancer

Why is it increasing?

- Obesity
- Increase antibiotic use in patients and food
- Increased consumption of processed food
- Inflammation
- Ambient radiation
Underutilization of Resources for Colorectal Cancer Screening in an Academic Outpatient Care Center

- 2196 patients
- 62% were not offered screening
- Compliance of colonoscopy was half that of stool testing

*Increase screening awareness*
*Follow through to ensure patients complete their screening examination*

Mishra et al. Tues 1020
When to Stop Screening?

2035: 78 million people > 65 years old

USPSTF:
- 50-75 screening age
- 76-85:
  - Up to date with negative examinations?
  - No prior exams with limited comorbidities?
- >85 don’t screen
Colon Cancer Screening Guidelines
NCCN Guidelines version 1.2014

Repeat colonoscopy in 5 years
  “Low risk” adenomatous polyps

Repeat colonoscopy in 3 years
  Between 3-10 adenomatous polyps
  Villous histology
  High grade dysplasia
  > 1 cm

Repeat colonoscopy earlier than above
  Incomplete preps
  Incomplete resection of polyps
When to Stop Surveillance

No definitive guidelines

USMSTF: “Decision to continue surveillance should be individualized, based on an assessment of benefit, risk and comorbidities.”

- 51% were uncomfortable with stopping
- Polyps found >85 year olds, but few cancer progression

Maratt et al. Clin Gastro Hepatology 2018
Surveillance guidelines

Evidence supporting recommendations is sparse

Are they accurate?

Increased polyp detection
+ Increased aged population

*Significant increase in colonoscopies*
Risk of Colorectal Cancer and Related Mortality Following Detection and Removal of High Risk Adenomas and Low Risk Adenomas

- 64,422 patients screened, followed for 8.1 yrs:
  - ~11,000 LRA (1-2 small tubular adenomas)
  - ~7500 HRA

- CRC risk identical for LRA and no adenomas
- Absolute risk for CRC in HRA 2.03%

Lee et al. presentation 689
Kaplan-Meier CRC Incidence Probability Curves
Colonoscopies at 2004-2016, age 50-75, follow-up through 12/2017

<table>
<thead>
<tr>
<th>Event Probability</th>
<th>Years after Colonoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>HIGH_RISK</td>
<td>0</td>
</tr>
<tr>
<td>LOW_RISK</td>
<td>0</td>
</tr>
<tr>
<td>NO_ADENOMA</td>
<td>0</td>
</tr>
</tbody>
</table>

No. at risk
- High Risk Adenoma: 22106
- Low Risk Adenoma: 38586
- Non-Adenoma Group: 119308
Where is the lesion?
Sessile Serrated Adenoma
Sessile Serrated Adenomas

Detection from 6-13% screening colonoscopy

Follow up confusing

Different pathway to cancer

Proximal location
Hyperplastic vs SSP
Sessile Serrated Adenoma

Risk of Colorectal Cancer Incidence and Mortality after Removal of Sessile Serrated Polyps: A Swedish Linkage Study

- Risk of cancer 31/10,000 vs 10/10,000
- Twice mortality

Complete removal of SSP and appropriate follow up
Diligent resection technique

Song et al. Mo 1709
Sessile Serrated Adenoma

Incidence of Metachronous Sessile Serrated Polyps and Surveillance Colonoscopy Intervals

- Follow up of SSP found on screening
- 29.7% had metachronous SSP
- 43% had tubular adenoma on subsequent exam

Surveillance of SSP indicated
Follow published guidelines

Pan et al. Mon 1716
Sessile Serrated Adenoma

Risk of Metachronous Colorectal Cancer Among Individuals with a History of Serrated Polyps – Data from a Large Integrated Healthcare System

- Large Proximal SSP: Hazard ratio 5.1
- Proximal SSP unknown size: 2.3
- Large SSP and adenoma: 4.8

*Large Proximal SSP portend a cancer risk
Close follow up recommended*
Adherence to Post-Polypectomy Surveillance Guidelines: A Systemic Review and Meta-Analysis

- Articles reporting screening and surveillance adherence
- Mean adherence rate 48.8%
  - Shorter surveillance time: 31-51%
  - Longer surveillance time: 1.4-14.7%

Overall, ~50% patients with incorrect surveillance recommendations

Cost increase, but no data on decreasing interval cancer rates
ADR and Colon Cancer Death

**Interval cancer**: 6 months – 10 years after screening

Early interval cancer vs Delayed cancer

Increased ADR corresponded to decrease in cancer diagnosis and decrease in cancer deaths
## ADR and Colon Cancer Death

<table>
<thead>
<tr>
<th>Quintile</th>
<th>ADR (range)</th>
<th>Cancer diagnosis</th>
<th>Risk Per 10,000 pt-ys</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.56% (7.35-19.05)</td>
<td>186</td>
<td>9.8</td>
</tr>
<tr>
<td>2</td>
<td>21.5% (19.06-23.85)</td>
<td>144</td>
<td>8.6</td>
</tr>
<tr>
<td>3</td>
<td>25.7% (23.86-28.40)</td>
<td>139</td>
<td>8.0</td>
</tr>
<tr>
<td>4</td>
<td>30.96% (28.41-33.50)</td>
<td>167</td>
<td>7.0</td>
</tr>
<tr>
<td>5</td>
<td>38.86% (33.51-52.51)</td>
<td>76</td>
<td>4.8</td>
</tr>
</tbody>
</table>
Adenoma Miss Rates

Small adenomas (< 5 mm): 27%

Large adenomas (5-10 mm): 11-17%

Cancer: 5%
Factors Affecting ADR

Bowel prep quality

Boston Bowel Prep Score
- 0-3 points in right, left and transverse colon
- Validated scoring system

Miss rate: Adenoma > 5mm
- 5.6% with score of 3
- 5.2% with score of 2
- 15.9% with score of 1
Factors Affecting ADR

Patients with BBPS 1 in any segment:

- 6% missed advanced adenoma
- 2.5% misses SSP
- Polyp < 5 mm missed 34%
- Polyp > 5 mm missed 23.5%
- Adenoma > 5 mm missed 15.9%

43.5% altered screening interval with improved BBPS
A word about bowel preps...

Large number of abstracts
Basically all have the same message:

Split the dose
Drink the whole thing
Clear liquids the day before

Unfortunately, no ground breaking science presented regarding bowel preparation
A word about quality measures

Adenoma detection rate (ADR)
   Men: 30%
   Women: 25%

90-95% cecal intubation rate

90% Adherence to screening intervals

85% colonoscopies with adequate bowel preparation
Adenoma Detection Rates During Insertion and Withdrawal vs. Only on Withdrawal: Prospective Randomized Trial

- ADR: 64% study population
- ADR: 68% control population
- Adenoma per procedure: 1.9 vs 1.6
- Adenoma per positive procedure: 2.5 vs 2.7

*Extremely high ADR’s and advanced metrics*

Cheng et al Presentation 1023
Technical Abstracts

Comparison Between Water Assisted Colonoscopy vs Second Forward View Examination of the Right Colon on Adenoma Detection Rate

• ADR ~48% in both groups

High ADR reported in study

Contivilio de Silva et al Sun 1670
Which Combination Works Best? A Comparison of Endocuff and Amplifeye in Underwater and Air Insufflation Colonoscopy

- Add on devices both outperformed water immersion
- ADR 30-60%
Technical Abstracts

Very high Adenoma Detection Rates

Hawthorne effect?

Is that a bad thing?

Should we be striving for higher numbers?
Consider these variables...

- Adenoma detection rates (ADR)
- Colonoscopy withdrawal time
- Number of procedures
- Time of day
- Quality of bowel preparation
Artificial Intelligence
Artificial Intelligence

10.3 mm
Artificial Intelligence

Ability to detect polyps in view
Differentiate between adenoma and hyperplastic
Easy to implement
Cost effective
Available
Artificial Intelligence

536 colonoscopy compared to 522 Artificial Intelligence

- ADR: 20.3% \(\rightarrow\) 29.1%
- Adenoma per patient: 0.31 \(\rightarrow\) 0.53
- Hyperplastic: 52 \(\rightarrow\) 114

Wang et al. Gut 2019 1-7
Artificial Intelligence

Deep learning algorithms and ability to differentiate adenoma from non-neoplastic tissue

- Sensitivity: 96%
- Specificity: 78%
- PPV: 90%
- NPV: 91.5%

"Optical biopsy" decreases laboratory cost by providing real time histology

Chen et al. Gastroenterology 2018 568-575
Artificial Intelligence for Colorectal Polyp Detection: High Accuracy and Detection Anticipation with CB-17-08 Performance

- Convoluted Neural Network
- Trained to detect polyps
- Compared to expert endoscopists
- Boasts ~100% sensitivity
- Faster detection than human
Artificial Intelligence will help in Determining the need for Additional Surgery After Endoscopic Resection of T1 Colon Cancer: Analysis Based on a Big Data for Machine Learning

- May decrease the need for surgery after resection
- Validate endoscopist technique and skill

Ichimara et al presentation 475
Artificial Intelligence

Early stages of development

Reliance may breed complacency

Deep learning has inherent lack of interpretability

Endorsement of GI Societies

Reimbursement

FDA approval
Conclusion

- Adhere to screening guidelines
- Consider start screening at age 45
- Encourage people over 50 to get screened
- Adhere to quality measures
- Track and Improve your Adenoma Detection Rates
- Keep an eye out for new technology
Thank you