Budget impact analysis of capsule endoscopy for scheduled monitoring in Crohn’s Disease

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OBJECTIVES: Crohn’s disease, a chronic inflammatory condition of the gastrointestinal tract, is associated with substantial healthcare costs. Endoscopic monitoring is a considered essential for monitoring and optimizing treatment. Ileoileocolonoscopy visualizes the cecal and terminal ileum but additional imaging is required to evaluate the entire bowel. Small bowel capsule endoscopy (SBC-CE) evaluates the entire small bowel and cecum in a single assessment. This analysis considers whether use of SBC-CE could reduce costs.

Methods: A patient-level, discrete-event simulation evaluated care and costs in 2016 USD in 1,000 patients representing 140,184 patients in the health plan over 5 years. During each cycle, patients were exposed to the risk of disease progression, adverse events, surgery, and death. Disease state changes used underlying Markov models for development of disease, treatment, surgery, and death. Treatment decisions were reviewed every 3 months using patient-reported information and marker assessment or results from endoscopic monitoring. Monitoring was performed every 3, 6, or 12 months for patients starting treatment, presenting with symptoms, or in remission, respectively.

Results: SBC-CE resulted in a lower total cost of care (~1.1%, -$189.2 million). Monitoring costs (~8.1%), treatment costs (~2.4%) and treatment costs (~0.4%) were reduced with SBC-CE compared with ileocolonoscopy. SBC-CE resulted in higher costs for patients with non-symptomatic disease, moving them to treatment more efficiently. Sensitivity analysis demonstrated that model results were robust to sampled changes in input parameters, with SBC-CE resulting in a reduced total cost of care in 82.4% of simulations and a median cost saving of $1.622 per patient.

Conclusions: Use of SBC-CE for monitoring of Crohn’s disease can result in reduced healthcare costs. Savings are generally realised in the cost of monitoring and avoidance of adverse events associated with ileocolonoscopy.

BACKGROUND

Crohn’s disease is an inflammatory Bowel Disease (IBD) commonly presenting at the end of the small bowel (terminal ileum) or the start of the colon. About 33,000 cases of Crohn’s disease are diagnosed each year in the USA [1]. The burden of Crohn’s disease in the USA is extensive: Crohn’s disease increases healthcare costs by circa $7,500 per patient per year in the USA [1].

Crohn’s DISEASE MONITORING

Endoscopic inspection is considered essential [2]. ileocolonoscopy cannot assess the small bowel and has been shown to miss active disease in the terminal ileum [3]. ileocolonoscopy has been demonstrated to be miss active disease in the terminal ileum. Small bowel capsule endoscopy (SBC-CE) is now available.

AIMS

To quantify the budget impact of switching Crohn’s patients from monitoring with ileocolonoscopy to MRE/CT to SBC-CE.

METHODS

Data identification

- Structured searches of PubMed were performed to identify publications relating to the incidence and costs of Crohn’s disease, related adverse events (AEs), and treatment.
- Title/abstract searches and Medline terms restricted hits to abstracts on IBD
- Searches were performed on November 7, 2016
- Costs of monitoring were taken from the Medicare 2016 fee schedule

Budget-impact model

- A patient-level, discrete-event simulation evaluated care and costs in 2016 USD in 1,000 simulated patients over 5 years
- At each 3-month cycle, patients were exposed to the risk of disease progression, adverse events, surgery, and death
- A Markov model for mucosal healing/deterioration simulated development of stricturing, strictureting, rectal disease, and anatomic involvement
- Monitoring was every 3, 6, or 12 months for patients starting treatment, presenting with symptoms, or in remission, respectively.
- When not used in a cycle, patient-reported information and marker assessment (PRIMA) informed treatment decisions
- Treatment was assigned dependent on patient risk-levels

Base case

- 140,184 Crohn’s disease patients in the health plan [4]
- Mean characteristics of age 42 years, 43.5% male, weight 83.6 kg, and CDAI score of 220 points [5,6]
- The performance (sensitivity and specificity) and cost of monitoring modalities is presented in Table 1
- Monitoring AEs included SBC-CE retention in 2% of cases and, for ileocolonoscopy, gastrointestinal bleeding (0.4%) and bowel perforation (0.07%)
- Monitoring was 90% ileocolonoscopy and 10% SBC-CE in the standard of care arm, whereas 50% of monitoring visits used SBC-CE in the comparator arm.
- The SBC-CE market share increased by 10% per annum.
- MRE/CT monitoring was used in conjunction with L1-L4 disease, it was added to all ileocolonoscopies and 20% of SBC-CE.
- Treatment options for active disease were Vedolizumab, Natalizumab, Infliximab, and corticosteroids
- Respective market share (%) ranged from 10:10:20:10 in high-risk patients
- The model time horizon was 5 years with 3.5% annual discounting

Sensitivity analyses

- Probabilistic analysis evaluated the robustness of results to changes in input parameters
- 500 samples of 200 bootstrapped patients provide median cost savings.

Table 1. Effectiveness and cost of monitoring modalities

<table>
<thead>
<tr>
<th>Monitoring</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Cost ($), USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMA</td>
<td>67% [10]</td>
<td>44% [10]</td>
<td>0.00</td>
</tr>
<tr>
<td>MRE</td>
<td>77% [12]</td>
<td>80% [12]</td>
<td>296.16</td>
</tr>
<tr>
<td>SBC-CE</td>
<td>93% [14]</td>
<td>84% [14]</td>
<td>938.70</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

In the base case, the total cost of care for Crohn’s disease was estimated at $15.57 billion over 5 years (Table 2)

- The saving was $169.2 million over 5 years, or $236 per patient/year

Table 2. Base case results

<table>
<thead>
<tr>
<th>Cost outcomes at 5 years, USD</th>
<th>10% SBC-CE</th>
<th>50% SBC-CE</th>
</tr>
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<tbody>
<tr>
<td>Total</td>
<td>$15.57 billion</td>
<td>$15.40 billion</td>
</tr>
<tr>
<td>Monitoring</td>
<td>$932 million</td>
<td>$854 million</td>
</tr>
<tr>
<td>Treatments</td>
<td>$13.35 billion</td>
<td>$13.29 billion</td>
</tr>
<tr>
<td>Adverse events</td>
<td>$1.28 billion</td>
<td>$1.25 billion</td>
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</tbody>
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CONCLUSIONS

Healthcare costs associated with Crohn’s disease were reduced by use of pan-intestinal SBC-CE for monitoring.

Using SBC-CE, diagnosis of active disease in the terminal ileum and small bowel is possible without need for MRE/CT.

Adverse events associated with ileocolonoscopy are avoided, leading to cost savings for SBC-CE.

REFERENCES