Predictors of DEXA Use and Guideline Performance for the Detection of Low Bone Mineral Density in Inflammatory Bowel Disease

Jason Etzel
Resident Research Forum
Seattle VAMC
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Background

- Increased prevalence (~15%) of osteoporosis and fracture risk in inflammatory bowel disease (IBD) patients.  
  
- DEXA results are a marker for fracture risk.

- Steroid exposure and advanced age are greatest risk factors for low bone mineral density (BMD) and fractures in the IBD population.

- Debate exists regarding greater risk in Crohn’s versus ulcerative colitis.

- Bisphosphonate treatment has been shown to improve BMD in this population.

1 Lichtenstein et al. *Inflamm Bowel Dis.* 2006 Aug;12(8):797-813
3 Bernstein et al “Osteoporosis & Inflammatory Bowel Disease” ACG Monograph, 2003
Guideline Synopsis

- British Society of Gastroenterology (2000)
  - Males with Crohn’s disease age > 55 years
  - Postmenopausal women
  - Systemic steroid use
  - Low impact fracture

  - Order DEXA based on risk factor profile (advanced age, hypogonadal state, steroid use, previous fracture, family history)

  - Order DEXA based on risk factor profile
  - Age > 60 years
  - Systemic steroid use >3 months

- Crohn’s and Colitis Foundation of America (2006)
  - Age > 65 years
  - Systemic steroid use >3 months
  - Low impact fracture
  - Selective testing based on other risk factors
Background – Guideline Utility


- 100 consecutive DEXA studies using the following criteria:
  - Age > 60 years (0% of population)
  - Steroid use > 3 months (92% of population)
  - Postmenopausal (7% of population)
  - Low impact fracture (7% of population)
- Detected 44% osteopenia, 12% osteoporosis
Aims

- To determine which factors affect the use of DEXA testing in the IBD population.
- To determine if published guidelines identify a subset of the IBD population with increased prevalence of low BMD.
Veterans’ Affairs quality assurance database (CHIPS) identified 2856 patients with at least one ICD9 code diagnosis for IBD from seven Pacific Northwest locations:

- Anchorage
- Portland
- Puget Sound
- Roseburg
- Spokane
- Walla Walla
- White City

2045 with confirmed IBD by manual chart review

Demographic, health care utilization, radiology and pharmacy data extracted from CHIPS

Presence of low impact fractures and non-VA DEXA studies assessed by chart review
# Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>61.0 +/- 0.34</td>
</tr>
<tr>
<td>Gender</td>
<td>Male 93%, Female 7%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>White 64%, Black 2%, Other 2%, Unknown 31%</td>
</tr>
<tr>
<td>IBD Type</td>
<td>Ulcerative Colitis 57%, Crohn’s 34%, Indeterminate 9%</td>
</tr>
</tbody>
</table>
## Demographics

<table>
<thead>
<tr>
<th>Health Care Utilization</th>
<th>Tertiary</th>
<th>Non-Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility</td>
<td>57%</td>
<td>43%</td>
</tr>
<tr>
<td>Visits to Multiple VA Sites</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Length of Follow-up (years)</td>
<td>4.5 +/- 0.1</td>
<td></td>
</tr>
<tr>
<td>Primary Care Enrollment</td>
<td>62%</td>
<td></td>
</tr>
<tr>
<td>Gastroenterology Enrollment</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Endocrine Enrollment</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>IBD Admission</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Steroid Use</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>
Epidemiology

- 359 DEXA performed
  - 317 performed after IBD diagnosis established
    - 26% Osteoporosis
    - 48% Osteopenia

DEXA Utilization

- 1673 patients with greater than one year follow-up
  - 1197 (72%) patients whom met at least one criterion for testing
    - 949 Age > 60 years
    - 453 Steroid use >3 months
    - 137 Low impact fracture
    - 52 Menopausal
  - 283 DEXA studies performed within this subset
    - Testing rate 23.6%
## Predictors of DEXA Testing

Cox Proportional Hazards Model applied to IBD patients with greater than one year of follow-up and no DEXA testing prior to IBD diagnosis*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted Hazard Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 60 years</td>
<td>1.25</td>
<td>0.98 - 1.60</td>
<td>0.07</td>
</tr>
<tr>
<td>Steroid Use &gt; 3 mo</td>
<td>2.12</td>
<td>1.67 - 2.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Low Impact Fracture</td>
<td>2.23</td>
<td>1.62 - 3.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Menopause</td>
<td>3.60</td>
<td>1.69 - 7.64</td>
<td>0.001</td>
</tr>
<tr>
<td>Tertiary Center</td>
<td>2.74</td>
<td>1.77 - 4.23</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Crohn’s Disease</td>
<td>1.93</td>
<td>1.30 - 2.87</td>
<td>0.001</td>
</tr>
<tr>
<td>Ulcerative Colitis</td>
<td>1.18</td>
<td>0.79 - 1.76</td>
<td>0.42</td>
</tr>
<tr>
<td>Number of IBD related visits</td>
<td>1.01</td>
<td>1.01 - 1.02</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of IBD related admissions</td>
<td>0.93</td>
<td>0.90 - 0.97</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* Included in model but not significant: Number of primary care, gastroenterology, and endocrinology visits, presence of DEXA scanner on site, infliximab use, and female gender. BMI was excluded from the above model due to lack of data for multiple subjects. When included in the model it is not a significant variable.
DEXA Utilization

Percent Tested

- Overall*: 23.6%
- Age > 60 yr: 20.1%
- Steroid > 3 mo: 37.7%
- Low Impact Fx: 40.9%
- Menopause: 53.8% (p<0.001)
- Tertiary*: 32.8%
- Community*: 13.5%
- Crohn’s*: 33.6%
- UC*: 18.3%

N=1197, N=949, N=453, N=137, N=52, N=628, N=569, N=387, N=676
Stepwise Guideline Compliance

p<=0.001

Percent Tested

11.6% 17.3% 36.8% 58.1% 33.3%

N=476 N=852 N=299 N=43 N=3

Number of Criteria Met
Guideline Criteria Increase Low Bone Mineral Density Detection

<table>
<thead>
<tr>
<th>Bone Mineral Density</th>
<th>Meet Screening Criteria (n=264)</th>
<th>Do Not Meet Screening Criteria (n=53)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>23%</td>
<td>40%</td>
</tr>
<tr>
<td>Osteopenia</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>27%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Guideline criteria do not improve detection of osteoporosis (p=0.49, Fisher’s exact), however do increase detection of low BMD (osteopenia + osteoporosis, p=0.025, Fisher’s exact).
Guideline Effectiveness Increases with Greater Number of Criteria Met

Greater number of criteria met is associated with low BMD (p=0.002) and osteoporosis (p=0.03)
## Age Cutoff Performance

<table>
<thead>
<tr>
<th>Age Cutoff</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 55 years</td>
<td>91.8%</td>
<td>18.1%</td>
<td>72.4%</td>
</tr>
<tr>
<td>≥ 60 years</td>
<td>86.3%</td>
<td>25.3%</td>
<td>70.3%</td>
</tr>
<tr>
<td>≥ 65 years</td>
<td>77.8%</td>
<td>26.5%</td>
<td>64.4%</td>
</tr>
</tbody>
</table>
Limitations

- **DEXA may have been performed at other facilities**
  - Majority of VA users receive care solely within VA
  - Chart review for non-VA DEXA results
- **Potential for diagnostic suspicion bias**
  - Only 17% had DEXA performed
  - DEXA was not randomly performed
  - DEXA may have been ordered based upon suspicion of disease
Conclusions

- Low BMD has high prevalence in the DEXA tested US Veterans’ IBD population (74%), even when risk factors are absent (60%)
- In this large study of over 2000 US veterans with IBD, 70% had risk factors for low BMD, but only 21% of this subset had a DEXA performed
- DEXA testing is inadequate in patients with risk factors for low BMD. Testing is particularly suboptimal for:
  - Patients of advanced age
  - Patients with ulcerative colitis
  - Patients receiving care at non-tertiary care medical centers
- Further provider education about osteoporosis in IBD patients is needed.
Conclusions

- Adherence to guidelines detects a population with increased prevalence of low BMD.
- Patients with a greater number of guideline criteria met have increased prevalence of low BMD.
- Future studies should investigate
  - the impact of interventions to increase DEXA testing
  - the treatment patterns when low BMD is identified
  - the effectiveness of low BMD treatments in IBD, specifically clinical fracture outcomes