

Consensus-Based Guidance for Bone Health Optimization in Spine Surgery

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Introduction

Background:

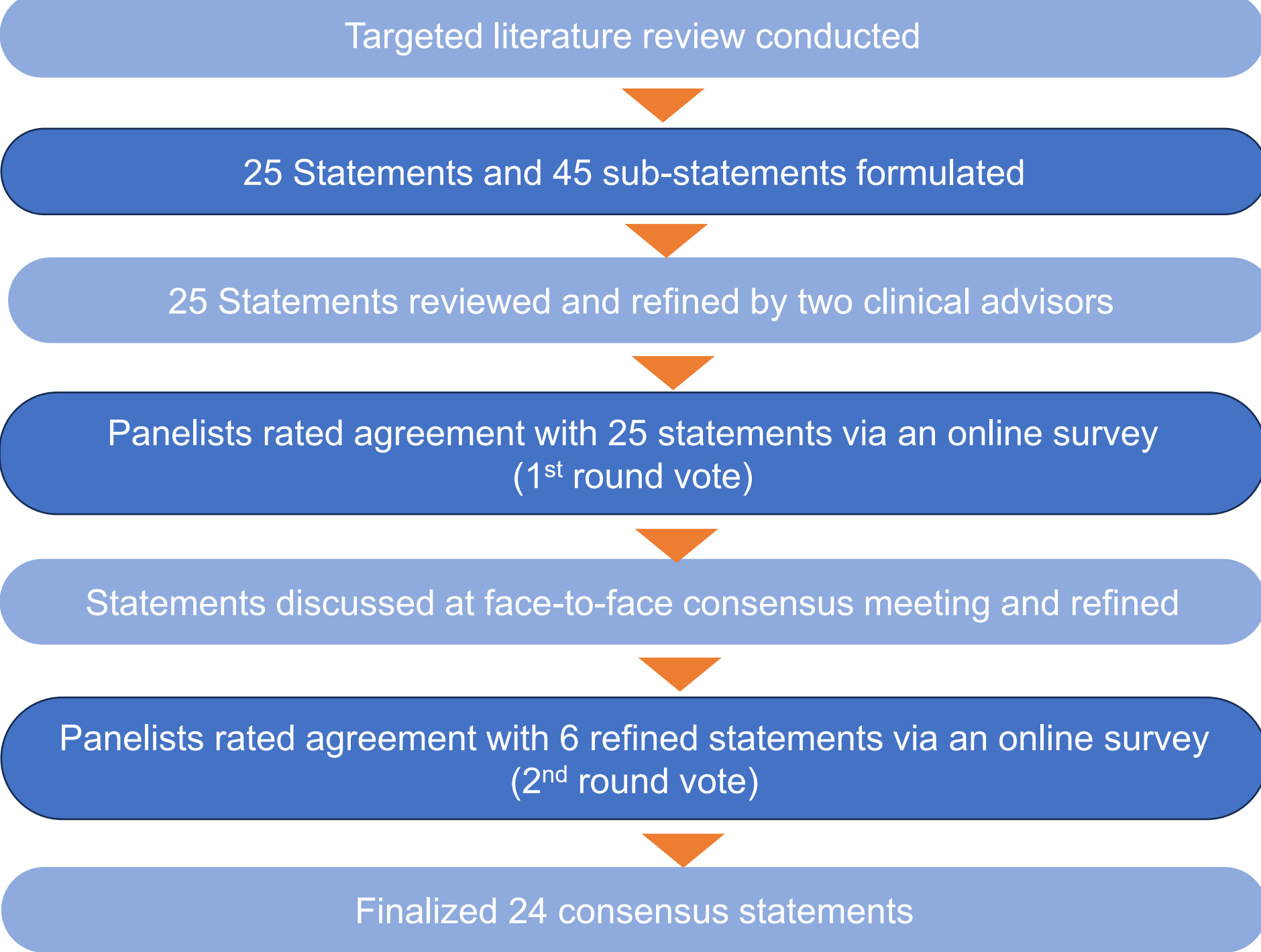
- Osteoporosis and poor bone health are highly prevalent among spine surgery patients, increasing risk of postoperative complications and revision surgery^{1,2}.
- Bone Health Optimization (BHO) aims to improve surgical outcomes and reduce osteoporosis-related complications (ORCs)^{3,4}.
- Preoperative bone health screening rates remain suboptimal in Asia, including Thailand, due to lack of standardized guidance^{5,6,7}.

Objective:

- This study aims to develop consensus-based guidance for bone health optimization in instrumented spine surgery for Thailand, addressing gaps in local practice and promoting optimal outcomes.

Methods

- This study utilized a Modified Delphi method with 10 Thai orthopedic spine experts to develop expert consensus on BHO for instrumented spine surgery.
- Targeted literature review, two online surveys, and a face-to-face consensus meeting (Dec 2024–Feb 2025).
- 25 main statements and 45 sub-statements drafted, focusing on patient evaluation, assessment tools, and risk stratification.
- Consensus defined as ≥70% agreement or disagreement; strength of recommendation rated 0–3 based on 4-point Likert scale.



Results

1. Patient Evaluation for Bone Health Optimization (BHO)

- Unanimous agreement that bone health evaluation is necessary before instrumented spine surgery in patients aged ≥60 years.
- Evaluation is optional for patients aged 50–59 years, based on surgeon’s clinical judgment.
- Spine surgeons should assess osteoporosis risk factors, fracture history, and fall history in all patients prior to surgery.

2. Assessment Tools for Evaluating Bone Health

- FRAX score recommended as an important tool for fracture risk assessment.
- DXA scan recommended for women ≥65 years and men ≥70 years, regardless of risk factors.
- DXA testing also recommended for patients with specific risk factors (see Table 1).
- Alternative assessment sites (hip or distal radius) or additional tools should be considered if spine DXA accuracy is limited.
- Optional tools for BMD assessment include:
 - CT-HU for osteoporosis detection when CT images are available.
 - Vertebral Fracture Assessment (VFA) prior to surgery; if unavailable, lateral X-ray imaging is recommended.
 - Trabecular Bone Score (TBS) for patients with Type 2 Diabetes (T2DM) and primary hyperparathyroidism (PHPT).
 - MRI-based Vertebral Bone Quality (VBQ) score as a supplementary tool.
- Measurement of serum 25-hydroxyvitamin D levels prior to surgery is recommended.

3. Risk Stratification and Recommendations

- Consensus on risk stratification criteria:
 - Normal/Low Risk:** No fracture history and T-score > -1.0 or CT-HU at L1 HU >150.
 - Osteopenia/Intermediate Risk:** No fracture history and T-score -1.0 to -2.4.
 - Osteoporosis/High Risk:** Hip/spine fracture, T-score ≤ -2.5, T-score -1.0 to -2.4 with complex surgery, FRAX MOF 20–30%, hip fracture risk ≥3%, or VBQ >3.0.
 - Severe Osteoporosis/Very High Risk:** Recent/multiple fractures, T-score < -3.5, T-score ≤ -2.5 with complex surgery, or FRAX MOF >30%.
- All patients ≥60 years or with low calcium/vitamin D should receive supplementation prior to surgery
- For osteoporosis/high-risk and severe osteoporosis/very high-risk patients:
 - Bone-forming agents recommended as first-line treatment.
 - Antiresorptive agents as second-line if first-line is intolerable or unaffordable.
- For very high-risk/severe osteoporosis patients:
 - Cement augmentation and dual-thread screws recommended for pedicle screw fixation.
 - Surgical delay of at least 3 months, up to 9 months for complex/high-risk procedures.
- Postoperative treatment:**
 - Continue bone-forming agents for ≥9 months in high-risk patients; until full course is completed in very high-risk patients.
 - Transition to antiresorptive therapy after completion of bone-forming agents to maintain bone density.
- The detailed flowchart for BHO in instrumented spine surgery patients is shown in Figure 1

Figure 1. Consensus-Based Guidance for Bone Health Optimization in Instrumental Spine Surgery

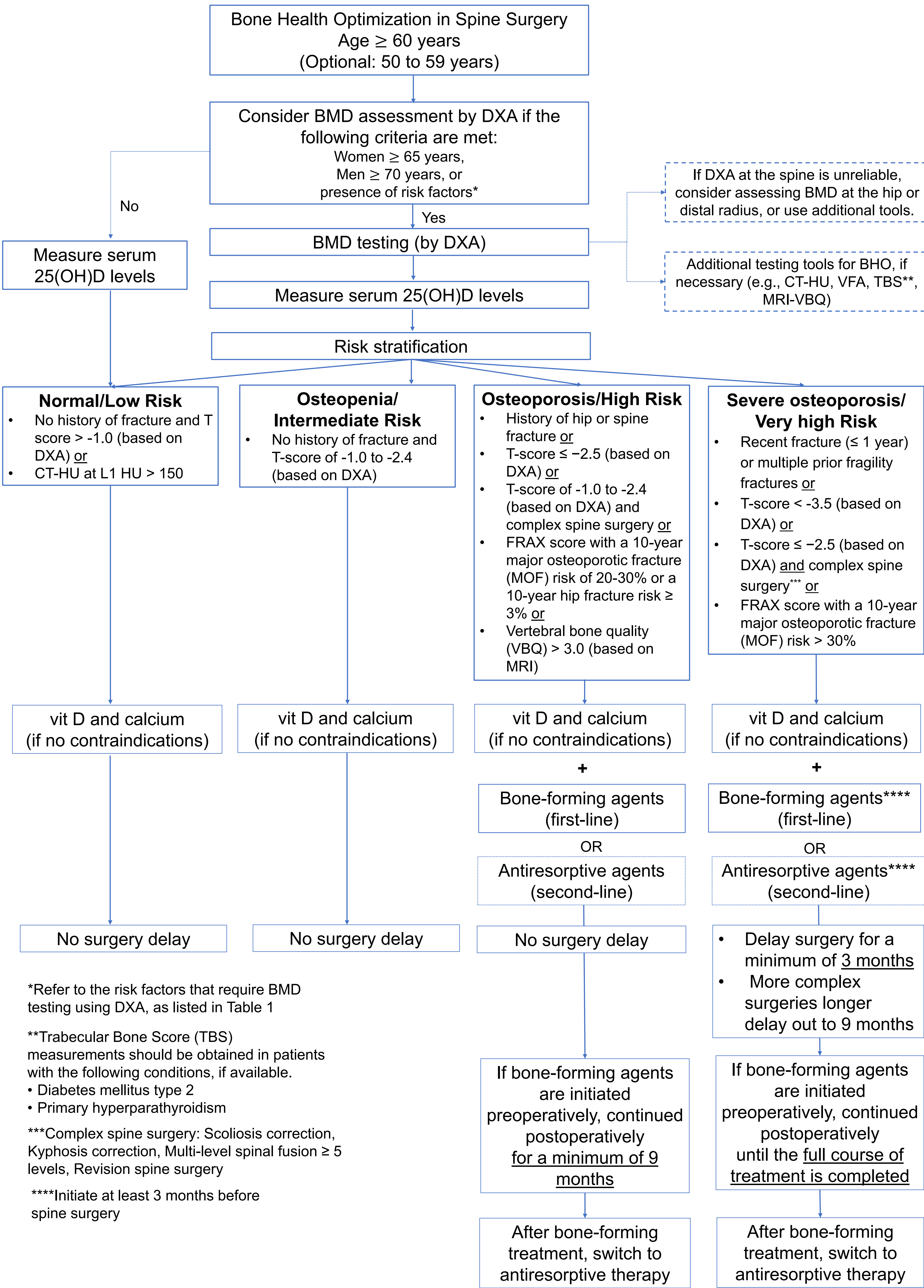


Table 1. Risk Factors Requiring BMD Testing Using Dual-energy X-ray Absorptiometry (DXA)

Patient condition	Surgery	Disease	Medication use
<div><div></div><div>Body Mass Index (BMI) < 20 kg/m²</div><div>A low-trauma fracture after 50 years of age</div><div>Limited mobility (e.g. wheelchair based)</div><div>Current smoking</div><div>FRAX MOF risk is ≥ 8.4% in the absence of BMD data</div><div>Family history of osteoporotic fracture or osteoporosis</div><div>Hypoestrogenism more than 1 year before menopause</div><div>Early menopausal women (< 45 year of age), including patients who have had bilateral oophorectomy</div><div>Patients with a recent 2-cm height change or a historical 4-cm height loss</div></div>	<div><div></div><div>Diabetes mellitus (long-term duration of diabetes >10 yr and poor control)</div><div>Inflammatory arthritis</div><div>Chronic kidney disease stage 3, 4, and 5</div></div>	<div><div></div><div>Exposed to chronic corticosteroids (≥5mg/d for 3 or more month of treatment)</div><div>Patients who have previously received treatment with an aromatase inhibitor or androgen deprivation therapy</div></div>	<div><div></div><div>Prior failed spine surgery due to poor bone health (e.g. fracture, pseudarthrosis, instrumentation failure)</div><div>Complex spine surgery (e.g. Scoliosis correction, Kyphosis correction, multi-level spinal fusion ≥ 5 levels)</div></div>

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