Comprehensive Geriatric Assessment for Elderly Patients

Jee Hyun Kim, M.D., Ph.D.
Seoul National University College of Medicine
Seoul National University Bundang Hospital
Contents

• Introduction on aging
  • Why do we need different approaches for older patients
• Geriatric assessment
  • Domains of GA
  • Clinical uses of GA in cancer
  • Screening tools
  • Application in oncology clinic
• Summary
World population is aging

Median age by major regions

World: population aged 0-4 and 65+

United Nations, World Population Prospects 2015
Aging = (homeostenosis)

- Progressive decline of stress tolerance due to restriction in the functional reserve of multiple organ systems.

![Graph showing the decline of various physiological properties with age.](image-url)
Physiology of aging

- **Pulmonary**
  - ↓ Elasticity, ciliary activity
  - ↓ V/Q mismatch
  - ↓ PO$_2$
  - ↓ Forced expiratory vol.
  - ↑ Residual volume

- **Endocrine**
  - ↓ IGF-1, GH, renin, Aldosterone, DHEA
  - ↓ T3, sex steroids
  - ↑ insulin, norepinephrine,
  - ↑ PTH, vasopressin, ANP

- **Immune System**
  - ↓ Thymic mass & hormones
  - ↓ Lymphocyte proliferation
  - ↑ Specific antibodies
  - ↑ IL-6, IL-1β, TGF-β
  - ↑ Total Ig, autoAbs,
  - ↑ monoclonal Igs

- **Body composition**
  - ↑ Fat
  - ↓ Muscle mass
  - ↓ Total body water

- **Cardiovascular**
  - ↓ Cathechol response
  - ↓ Maximal heart rate
  - ↓ Maximal C.O
  - ↓ Compliance
  - ↓ Elasticity

- **Nervous system**
  - ↓ Brain weight
  - Neuronal loss
  - ↓ AchEsterase, serotonin,
  - ↓ Dopamine receptor
  - ↓ Vision, hearing, taste

- **GI, Hepatic, Renal, Hematopoietic, Etc...**

- **GI, Hepatic, Renal, Hematopoietic, Etc...**

- **Nervous system**
  - ↓ Brain weight
  - Neuronal loss
  - ↓ AchEsterase, serotonin,
  - ↓ Dopamine receptor
  - ↓ Vision, hearing, taste

- **Cardiovascular**
  - ↓ Cathechol response
  - ↓ Maximal heart rate
  - ↓ Maximal C.O
  - ↓ Compliance
  - ↓ Elasticity
What’s different about older patients

• Disease presentation: atypical
  • Vague, atypical symptom
  • Change in eating/sleeping/toileting habit, fever may represent development of new illness
• Decreased physiologic reserve → develop symptoms at an earlier stage of their disease
  ▪ Heart failure by mild hyperthyroidism, urinary retention by mild BPH
  ▪ Drug side effects can occur at low dose
• Multiple pathology, polypharmacy
• Non-medical factors influence course of disease
Vulnerability of frail older patients
Where is the patient? – determine phase of aging (biological age)

Fit
Little limitation in activity
Independent

Vulnerable

Frail
Severe limitations with no significant recovery of functional reserve

Predeath

Frailty phenotype by Cardiovascular Health Study
• Unintentional weight loss
  (10 pounds = 4.5kg, or 5% of body weight loss/year)
• Self-reported exhaustion
• Weakness (grip strength in the lowest 20%)
• Slow gait speed
• Low physical activity


Frailty ≥ 3, pre-frail: 1-2, non-fit
Geriatric assessment

• Multi-dimensional, interdisciplinary evaluation tool used primarily by geriatricians to evaluate elderly patients’ functional and global health status
  • Focused on defining the “physiologic age” of the patient identifying those at greatest risk of hospitalization and functional decline
  • Identify and manage age-related problems
Domains of GA

- Comorbidity
- Functional status
- Physical performance
- Nutritional status
- Polypharmacy
- Social support
- Cognition
- Psychological status

- CCI, CIRS-G
- ADL, IADL
- Timed Up and Go, grip strength
- BMI, MNA, unintentional wt loss
- Use of inappropriate medications (Beers criteria), No of medications
- Medical outcomes survey
- MMSE, MCA, BOMC, Mini-Cog
- GDS, Hospitalized Anxiety and Depression Scale, Distress thermometer
Functional Status

- Activities of daily living (ADLs)
  - Bathing
  - Dressing
  - Toileting
  - Transferring
  - Continence
  - Feeding

Basic self-care skills required to maintain independence in the home
Assistance with ADLs

• Predictive of
  • Prolonged hospital stay
  • Worsening of function in the hospital
  • Greater home care use
  • Nursing home placement
  • Death

• Assistance in ≥ 1 ADL : average life expectancy of < 3 yrs

Functional Status

• Instrumental activity of daily living (IADLs)
  • Ability to use telephone
  • Shopping
  • Food preparation
  • Housekeeping
  • Laundry
  • Mode of transportation
  • Ability to take own medications
  • Ability to handle finances

Higher order of function required to maintain independence in the community
# Needs for functional assistance → future institutionalization and mortality

<table>
<thead>
<tr>
<th>N=7527 Age 70+</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risk of institutionalization (95% CI)</td>
</tr>
<tr>
<td>IADL assistance</td>
<td>6.7 (4.6-9.6)</td>
</tr>
<tr>
<td>ADL assistance (moderate)</td>
<td>9.8 (6.8-14.0)</td>
</tr>
<tr>
<td>ADL assistance (severe)</td>
<td>17.0 (9.1-32.0)</td>
</tr>
</tbody>
</table>


Follow up (1990)

*Mor et al, Am J Public Health, 1994*
Assistance with IADLs

- Better baseline IADL ($p=0.04$) significantly associated with better survival
Comorbidity

• Concurrent, independent health condition
• Increases with age
• Increase all cause mortality
  • ≥ 3 comorbidities associated with lower survival in cancer patients
• Increase the risk of complications
• Modify cancer behavior
• Mask symptoms with subsequent delays in cancer diagnosis
• Cancer treatment may worsen comorbidities or increase the frequency of drug interactions

Yancik et al, Cancer 1997
## Effect of comorbidity on survival in early breast cancer

<table>
<thead>
<tr>
<th>Number of comorbid illnesses</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>≥ 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>483</td>
<td>288</td>
<td>124</td>
<td>41</td>
</tr>
<tr>
<td>Mean age (y)</td>
<td>60</td>
<td>65</td>
<td>69</td>
<td>70</td>
</tr>
<tr>
<td>Breast cancer/other</td>
<td>4.1</td>
<td>1.7</td>
<td>0.8</td>
<td>0.3</td>
</tr>
</tbody>
</table>


### Table 3. Cause of Death According to Age Group

<table>
<thead>
<tr>
<th>Age, y</th>
<th>55-64</th>
<th>65-74</th>
<th>75-84</th>
<th>≥85</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast cancer</td>
<td>48 (75.0)</td>
<td>33 (58.9)</td>
<td>38 (44.7)</td>
<td>16 (27.6)</td>
<td>135 (51.3)</td>
</tr>
<tr>
<td>Other cancer</td>
<td>4 (6.2)</td>
<td>6 (10.7)</td>
<td>9 (10.6)</td>
<td>3 (5.2)</td>
<td>22 (8.4)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>4 (6.2)</td>
<td>4 (7.1)</td>
<td>18 (21.2)</td>
<td>19 (32.8)</td>
<td>45 (17.1)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>0</td>
<td>1 (1.8)</td>
<td>4 (4.7)</td>
<td>8 (13.8)</td>
<td>13 (4.9)</td>
</tr>
<tr>
<td>Digestive system</td>
<td>1 (1.6)</td>
<td>1 (1.8)</td>
<td>3 (3.5)</td>
<td>4 (6.9)</td>
<td>9 (3.4)</td>
</tr>
<tr>
<td>Alzheimer disease/dementia</td>
<td>1 (1.6)</td>
<td>0</td>
<td>4 (4.7)</td>
<td>2 (3.4)</td>
<td>7 (2.7)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0</td>
<td>3 (5.2)</td>
<td>3 (5.2)</td>
<td>5 (1.9)</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>COPD/other respiratory</td>
<td>1 (1.6)</td>
<td>2 (3.6)</td>
<td>1 (1.2)</td>
<td>1 (1.7)</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (7.8)</td>
<td>4 (7.1)</td>
<td>2 (2.4)</td>
<td>2 (3.4)</td>
<td>13 (4.9)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>5 (8.9)</td>
<td>4 (4.7)</td>
<td>0</td>
<td>9 (3.4)</td>
</tr>
<tr>
<td>Total No. of Deaths</td>
<td>64</td>
<td>56</td>
<td>85</td>
<td>58</td>
<td>263</td>
</tr>
<tr>
<td>Total No. of Patients</td>
<td>622</td>
<td>624</td>
<td>427</td>
<td>127</td>
<td>1800</td>
</tr>
</tbody>
</table>

*Yancik R et al, JAMA 2001;285:885-92*
Cognitive function

• By age 85, 37% of all people have some sign of Alzheimer’s disease

• Evaluate **before** starting treatment!
  • Ability to follow complex directions
  • Ability to take medications on schedule
  • Ability to recognize toxicity and seek help
  • Family member to help

• Mini-mental status exam (MMSE), Montreal Cognitive Assessment (MoCA), Mini-Cog
Polypharmacy

• Age-related changes in PK and PD
  • Absorption: Change in gastric motility and bowel transit time
  • Distribution
    • Decrease in lean body mass & total body water (↓ Volume of distribution of water soluble drugs, with higher blood levels)
    • Increase in body fat (↑Vd of fat soluble drugs with increased half life)
    • Decrease in serum binding proteins, albumin (elevation of free-drug level even with the decreased total drug concentration)
  • Metabolism
    • Reduced liver mass & hepatic blood flow; reduced enzyme activity of P450 system
  • Elimination
    • Reduced renal blood flow and renal mass- decreased elimination
• Multiple comorbidities and multiple medications
Polypharmacy

• PIMs (Potentially Inappropriate Medications)
  • Consensus guideline known as Beers criteria (1995, updated in 2015): drug lists particularly problematic for older patients
  • Examples of PIMs: 1st generation antihistamines, ticlopidine, peripheral alpha-1 blockers, digoxin, nifedipine, amitriptyline, nortriptyline, paroxetine, benzodiazepines, megestrol, PPIs (> 8 weeks unless for high risk patients), etc
• Prevalence of polypharmacy and PIM in older patients with newly diagnosed cancer: 80% & 41%
  • Lead to adverse drug events and increased morbidity
• Adherence also an important factor in the success or failure of treatment

Clinical uses of CGA in cancer

• Uncover multiple geriatric problems not detected by routine history & physical examination, lead to targeted interventions, follow up on symptoms

• Predicts outcome
  • Survival
  • Postoperative complications
  • Chemotherapy-related toxicity

• Select appropriate treatment
  • May affect cancer treatment in more than 50% of older patients
Uncover multiple problems of elderly

- In 203 elderly patients with cancer..
  - Moderate correlation of ECOG PS with ADL ($\rho = 0.51$) and IADL ($\rho = 0.61$).

<table>
<thead>
<tr>
<th>ECOG PS</th>
<th>ADL</th>
<th>% Pts</th>
<th>Dependence level</th>
<th>% Pts</th>
<th>Dependence level</th>
<th>% Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>% pts</td>
<td></td>
<td>Dependence level</td>
<td>% Pts</td>
<td>Dependence level</td>
<td>% Pts</td>
</tr>
<tr>
<td>0</td>
<td>30.5</td>
<td>Independent</td>
<td>78.8</td>
<td>Independent (&gt;27)</td>
<td>43.8</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>52.7</td>
<td>Partial</td>
<td>19.2</td>
<td>Mild/moderate (14-27)</td>
<td>48.3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11.8</td>
<td>complete</td>
<td>2.0</td>
<td>Major (&lt;14)</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Extermann et al, J Clin Oncol 1998;16:1582-7
Repetto L et al, J Clin Oncol 2002;20:494-50210
Prospective multicenter cohort undergoing 1st line palliative chemotherapy, KCSG PC 13-09

(n=300, median age 75)
Prediction of post-surgical complication

- Preoperative Assessment of Cancer in the Elderly in 460 elderly receiving elective surgery (≥ 70)
  - CGA, assessment of fatigue (BFI), PS, ASA score

37.8% had at least one complication within 30 days after surgery
- Breast cancer (18.9%)
- GI cancer (59.9%)
- GU cancer (52.1%)

Complications were:
- Wound infection (19.8%)
- Respiratory morbidity (10.6%)
- Nutritional problem (7.7%)
- Cardiac failure (5.5%)

Association between components of PACE with surgical complications

• 30-day morbidity (any and major complications)
  • Moderate-severe fatigue (RR=1.46, 95% CI=1/18-2.13)
  • Dependent IADL (RR=1.36, 95% CI=1.04-2.05)
  • Abnormal PS (RR=1.64, 95% CI=1.07-2.52)
  • Abnormal ASA (RR=1.96, 95% CI = 1.09-3.53)

• Hospital stay

<table>
<thead>
<tr>
<th>Component of PACE</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMS abnormal (&lt;24)</td>
<td>1.18</td>
<td>0.76-1.86</td>
</tr>
<tr>
<td>ADL dependent (&gt;0)</td>
<td>2.01</td>
<td>1.37-2.93</td>
</tr>
<tr>
<td>IADL dependent (&lt;8)</td>
<td>1.58</td>
<td>1.11-2.24</td>
</tr>
<tr>
<td>GDS depressed (&gt;4)</td>
<td>1.30</td>
<td>0.91-1.85</td>
</tr>
<tr>
<td>BFI mod/severe fatigue (&gt;3)</td>
<td>1.29</td>
<td>0.90-1.84</td>
</tr>
<tr>
<td>ASA abnormal (≥2)</td>
<td>0.85</td>
<td>0.60-1.20</td>
</tr>
<tr>
<td>PS abnormal (&gt;1)</td>
<td>1.64</td>
<td>1.06-2.56</td>
</tr>
<tr>
<td>Satariano’s index (1)</td>
<td>1.23</td>
<td>0.85-1.78</td>
</tr>
<tr>
<td>Satariano’s index (2+)</td>
<td>1.36</td>
<td>0.70-2.65</td>
</tr>
</tbody>
</table>

• 275 patients (≥ 65yrs)

• Outcome
  • 1-year all-cause mortality rate, Postop complications, Hospital stay, Nursing facility

Kim SW, Kim KI et al. JAMA Surg 2014
Prediction of chemotherapy toxicity

Eligibility criteria
- Age 65 or older
- Diagnosis of cancer
- To start a new chemotherapy regimen

Pre-chemo Assessment

Chemotherapy toxicity
NCI CTCAE v3.0
(2 MDs)

Sample size: 500 patients
7 participating institutions (Cancer and Aging Research Group)

Hurria et al. JCO 2011
### Prediction of chemotherapy tolerance - risk prediction model incorporating CGA

<table>
<thead>
<tr>
<th>Risk factors for Gr 3-5 toxicity</th>
<th>OR (95% CI)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 72 vs &lt; 72</td>
<td>1.85 (1.22-2.82)</td>
<td>2</td>
</tr>
<tr>
<td>GI/GU cancer v other</td>
<td>2.13 (1.39-3.24)</td>
<td>2</td>
</tr>
<tr>
<td>Standard dose vs upfront dose reduction</td>
<td>2.13 (1.29-3.52)</td>
<td>2</td>
</tr>
<tr>
<td>Polychemotherapy vs monochemotherapy</td>
<td>1.69 (1.08-2.65)</td>
<td>2</td>
</tr>
<tr>
<td>Hb (M &lt; 11, F &lt; 10)</td>
<td>2.31 (1.15-4.64)</td>
<td>3</td>
</tr>
<tr>
<td>Ccr &lt; 34</td>
<td>2.46 (1.11-5.44)</td>
<td>3</td>
</tr>
<tr>
<td>1 or more falls /6 m</td>
<td>2.47 (1.43-4.27)</td>
<td>3</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>1.67 (1.04-2.69)</td>
<td>2</td>
</tr>
<tr>
<td>Limited in walking 1 block</td>
<td>1.71 (1.02-2.86)</td>
<td>2</td>
</tr>
<tr>
<td>Assistance with medication intake</td>
<td>1.50 (0.66-3.38)</td>
<td>1</td>
</tr>
<tr>
<td>Decreased social activity</td>
<td>1.36 (0.90-2.06)</td>
<td>1</td>
</tr>
</tbody>
</table>

*Hurria et al, JCO 2011*
Prediction of chemotherapy toxicity: CARG & CRASH score

**CARG study**
- Age ≥ 73
- GI or GU cancer
- Standard dose polychemotherapy
- Fall within past 6 months

**Assistance in IADL**
- Decreased social activity

**CRASH -heme**
- IADL score
- Serum LDH
- Diastolic BP
- Serum albumin

**CRASH non-heme**
- ECOG PS
- Hemoglobin
- CCr
- Albumin
- MMSE
- MNA
- Comorbidity

*Hurria et al, JCO 2011, Extermann et al Cancer 2011*
Risk factor of stopping further treatment after 1\textsuperscript{st} line chemotherapy, SNUBH (n = 98, aged ≥ 65)

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-malnutrition</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Malnutrition (&lt;17)</td>
<td>5.03</td>
<td>1.50-16.87</td>
<td>0.009</td>
</tr>
<tr>
<td>IADL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dependent</td>
<td>3.06</td>
<td>1.03-9.12</td>
<td>0.045</td>
</tr>
</tbody>
</table>

The frequency of stopping further treatment according to number of risk factors (malnutrition, dependent IADL)
ELCAPA study – can CGA change treatment plan?

- Patients 70 years or older with newly diagnosed cancer (N = 656)
- Treatment proposed by the oncologist: initial cancer treatment plan (n = 656)
- Referred to geriatrician Comprehensive Geriatric Assessment (n = 392)
- Multidisciplinary meeting: decision about the cancer treatment plan: final cancer treatment plan (n = 375)
- Undefined initial cancer treatment plan (n = 17)
- No change in the initial cancer treatment plan (n = 297)
- Change in the initial cancer treatment plan (n = 78)

Change in therapy

- Intensification 10%
- Decrease in cancer treatment intensity 80.8%
- Delay Tx to allow geriatric management 9%

Caillet P et al. JCO 2011;29:3636-3642
**GA in oncology clinics**

- US NCCN guideline & SIOG recommended some form of GA to help cancer specialists determine the best treatment for their older patients

- Several barriers to GA
  - Time consuming
  - Lack of trained staff
  - Lack of consensus / standardization of GA
  - Poor financial rewarding by health insurance
  - Not necessary in all elderly patients with cancer
  - Can geriatric assessment interventions lead to survival benefit in cancer patients?
## Screening tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Developed for</th>
<th>Items</th>
<th>Abnormal</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G8</td>
<td>Oncology pts</td>
<td>8</td>
<td>≤ 14</td>
<td>5</td>
</tr>
<tr>
<td>VES-13</td>
<td>General older pop</td>
<td>13</td>
<td>≥ 3</td>
<td>5</td>
</tr>
<tr>
<td>fTRST</td>
<td>Older pts at ED</td>
<td>5</td>
<td>≥ 2</td>
<td>2</td>
</tr>
<tr>
<td>GFI</td>
<td>General older pop</td>
<td>15</td>
<td>≥ 4</td>
<td>NR</td>
</tr>
<tr>
<td>SOF</td>
<td>General older pop</td>
<td>3</td>
<td>≥ 2</td>
<td>NR</td>
</tr>
<tr>
<td>Karnofsky PS</td>
<td>Oncology pts</td>
<td>1</td>
<td>≤ 80</td>
<td>1</td>
</tr>
<tr>
<td>ECOG PS</td>
<td>Oncology pts</td>
<td>1</td>
<td>≥ 1</td>
<td>1</td>
</tr>
<tr>
<td>Fried</td>
<td>General older population</td>
<td>5</td>
<td>≥ 3</td>
<td>NR</td>
</tr>
<tr>
<td>Barber</td>
<td>General older population</td>
<td>9</td>
<td>≥ 1</td>
<td>NR</td>
</tr>
<tr>
<td>ISAR</td>
<td>Older pts at ED</td>
<td>6</td>
<td>≥ 3</td>
<td>NR</td>
</tr>
<tr>
<td>OGS</td>
<td>Oncology pts</td>
<td>10</td>
<td>≥ 1</td>
<td>NR</td>
</tr>
<tr>
<td>aCGA</td>
<td>Oncology pts</td>
<td>15</td>
<td>≥ 1</td>
<td>5</td>
</tr>
<tr>
<td>Gerhematolim</td>
<td>Hematology pts</td>
<td>27</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>SAOP2</td>
<td>Oncology pts</td>
<td>15</td>
<td>≥ 1</td>
<td>NR</td>
</tr>
<tr>
<td>PPT</td>
<td>General older population</td>
<td>7</td>
<td>≤ 20</td>
<td>5</td>
</tr>
<tr>
<td>Handgrip</td>
<td>General older population</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

G8 (geriatric 8), VES-13 (vulnerable elders’ survey-13), fTRST (Flemish version of the Triage Risk Screening Tool), GFI (groningen frailty index), SOF (study of osteoporotic fractures), ISAR (Identification of Seniors at Risk), OGS (Onco Geriatric screening tool), aCGA (abbreviated CGA), SAOP (Senior Adult Oncology Program), PPT (Physical Performance Testing), ED (emergency department)
Systematic geriatric screening and assessment study

Patient ≥ 70 yrs

Screening by nurse with G8

G8 score ≤ 14

G8 score > 14

aCGA

Management decision

Questionnaire

Patients with unknown detected problems: 931 (51.2%) : Functionality (40.1%), Nutrition (37.6%), Falls (30.5%), Depression (27.2%), Pain (23.7%), Cognition (19.0%), Social status (25.7%)

Patients with planned interventions: 286 (25.7%)

Development of Screening tool: KG-7
Geriatric Assessment cohort (n=1284)

KG-7 (KCSG Geriatric Score-7)

1. Can you take a shower or bath without help?
2. Can you ascend the stairs without help?
3. Can you take care of all shopping needs independently?
4. How is the self-view of your nutritional status?
5. Do you take more than 3 prescription drugs per day?
6. What year, month and day is this?
7. Have you dropped many of your activities and interests?

Total points (    )/7 points

Validation of KG-7 in retrospective (n=99) & prospective cohort (n=300)

- The cut-off value was decided at \( \leq 5 \) points, with AUC 0.930

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>95.0%</td>
<td>59.2%</td>
<td>85.3%</td>
<td>82.6%</td>
</tr>
</tbody>
</table>

- In the retrospective validation cohort, the AUC was 0.82 (95% CI 0.73–0.90)

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.5%</td>
<td>48.6%</td>
<td>77.3%</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

- Prospective validation cohort (n=300) – ASCO 2017

Overall Survival according to KG-7, development cohort

P<0.001

Prospective validation study / biomarker substudy – ASCO 2017
Take home message

• Cancer is disease of aging
• Older patients have
  • Decreased organ function and stress tolerance
  • Competing cause of mortality (comorbidity)
  • Different tolerance to treatment
• Comprehensive geriatric assessment
  • Predicts survival, post-treatment complication
  • Uncover health problems of elderly, leading to intervention
  • Change in treatment selection
• Consideration of geriatric factors is essential in treatment decision: GA and focused intervention
Acknowledgement

Korean Cancer Study Group Geriatric Oncology Working Party

Seoul National University Bundang Hospital Geriatric Oncology Team