Multiple Myeloma

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Note: Consider Clinical Trials as treatment options for eligible patients.

INITIAL DIAGNOSTIC WORK-UP

- History and physical
- CBC with differential, BUN, creatinine, electrolytes, LDH, calcium, albumin, beta-2 microglobulin, serum protein electrophoresis and immunofixation, serum free light chain assay (kappa and lambda), immunofixation, and quantitative immunoglobulins (IgG, IgM, IgA)
- 24 hour urine protein electrophoresis and immunofixation
- Skeletal survey
- PET/CT scan
- Unilateral bone marrow aspirate and biopsy
  - Bone marrow immunohistochemistry
  - Bone marrow flow cytometry
  - Cytogenetics
  - FISH (t(4:14), t(14:16), t(11:14), Del 13, Del 17p) Del 1p (CDKN2C), 1 q21 (CKS1B)
- Dental evaluation[1]
- Lifestyle risk assessment[2]

If indicated:

- IgD and IgE
- Diagnostic imaging:
  - MRI (avoid gadolinium if creatinine clearance less than 30 mL/minute)
  - CT scan (consider avoiding intravenous contrast, if creatinine elevated)
  - Bone densitometry
- Tissue biopsy to diagnose extraosseous plasmacytoma
- Congo red staining of bone marrow and abdominal fat pad for amyloidosis (with or without Electron Microscopy [EM])
- Serum viscosity
- Gene expression profile (GEP)

TREATMENT

Smoldering (asymptomatic) myeloma[3]

- Low/ Intermediate risk → Observe at 2-3 month intervals
- High risk → Observe or consider clinical trial

Active (symptomatic) myeloma[3]

- Induction therapy (see Appendix B) **and**
- Bisphosphonates **and**
- Adjunctive treatment as indicated (see Appendix C)
- Evaluation for autologous stem cell transplant (SCT)

FOLLOW-UP/SURVEILLANCE

Progression?

- No → Smoldering (asymptomatic) myeloma[3]
- Yes → Active (symptomatic) myeloma[3]

Prior to each cycle, obtain the following labs:

- CBC with differential, BUN, creatinine, calcium
- Quantitative immunoglobulins
- Serum protein electrophoresis
- Free light chains (FLC) as appropriate every month
- Urine protein electrophoresis

If clinically indicated, consider:

- Bone marrow aspirate and/or biopsy
- Bone survey
- MRI
- PET/CT scan

See treatment following induction on Pages 2 and 3

[1] Screening evaluation prior to initiation of bisphosphantes and/or SCT

[2] See Physical Activity, Nutrition, and Tobacco Cessation algorithms; ongoing reassessment of lifestyle risks should be a part of routine clinical practice

[3] See Appendix A for Definitions

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Department of Clinical Effectiveness V4
Approved by The Executive Committee of Medical Staff 09/25/2018

Multiple Myeloma

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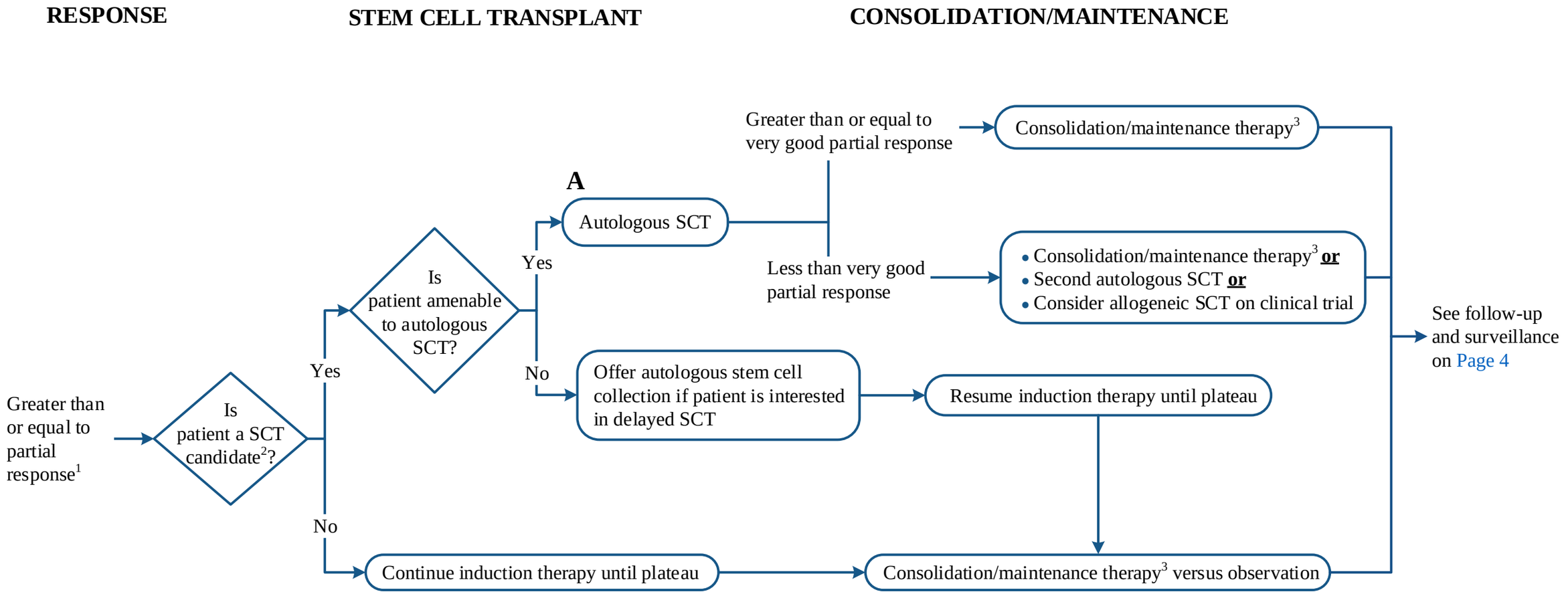

[1] See Appendix D for Response Criteria
[2] See Appendix E for Considerations For Undergoing SCT
[3] See Appendix B for Treatment

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Multiple Myeloma

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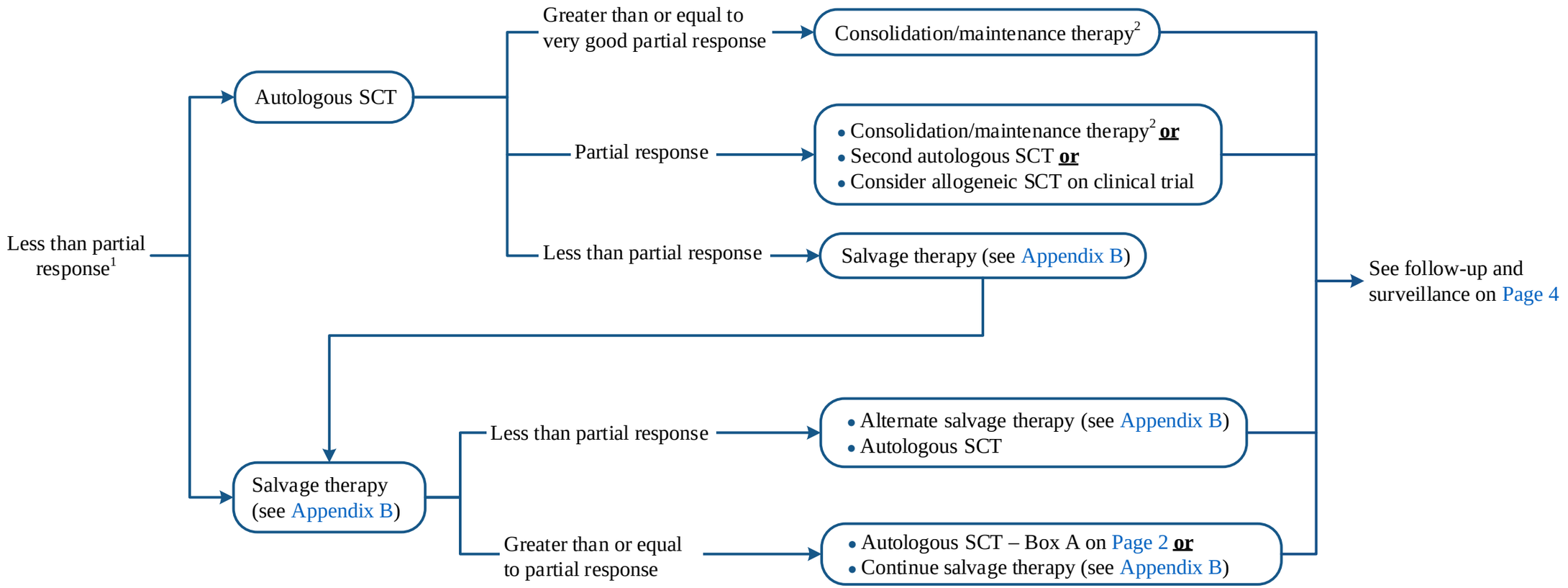
RESPONSE | **STEM CELL TRANSPLANT** | **CONSOLIDATION/MAINTENANCE**



[1] See Appendix D for Response Criteria
[2] See Appendix B for Treatment

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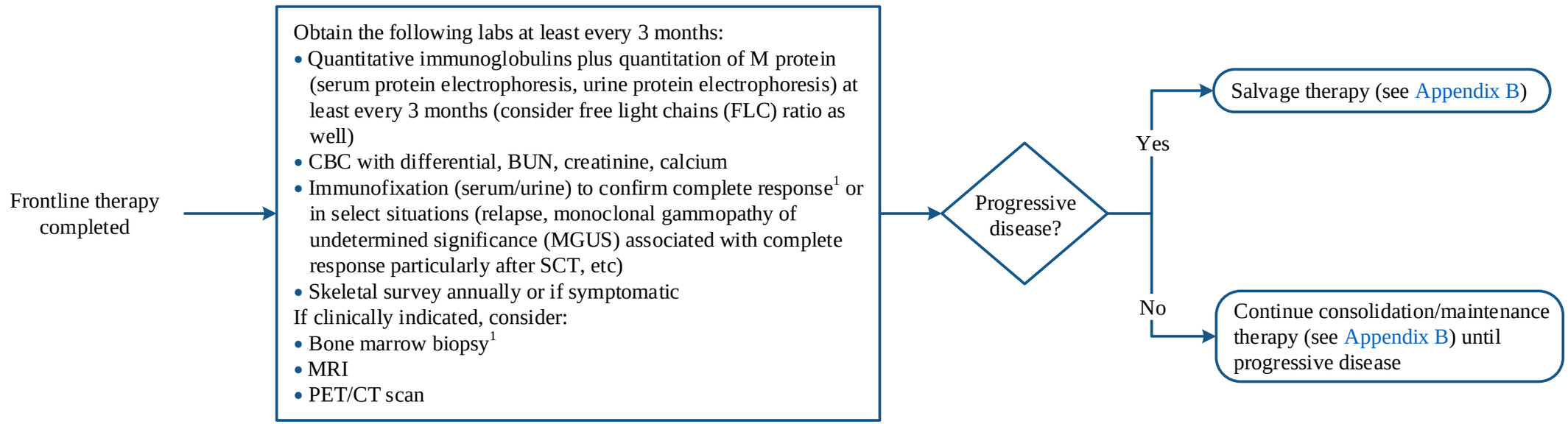
FOLLOW-UP/SURVEILLANCE



[1] If patient is in complete response, consider obtaining bone marrow biopsy to confirm minimal residual disease (MRD) status

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Note: Consider Clinical Trials as treatment options for eligible patients.

RELAPSE (PROGRESSIVE DISEASE) AFTER AUTOLOGOUS SCT

FOLLOW-UP/SURVEILLANCE

Relapse (progressive disease) less than 1 year post autologous SCT → Salvage therapy[1] with or without allogeneic SCT

Relapse (progressive disease) greater than or equal to 1 year post autologous SCT or any patient → Salvage therapy[1] with or without autologous/allogeneic SCT

[1] See Appendix B for Treatment

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APPENDIX A: Definitions

Smoldering (Asymptomatic) Myeloma

Both criteria must be met:

- Serum monoclonal protein (IgG or IgA) greater than or equal to 30 g/L or urinary monoclonal protein greater than or equal to 500 mg per 24 hour and/or clonal bone marrow plasma cells 10-60%
- Absence of myeloma defining events or amyloidosis

Active (Symptomatic) Myeloma

Clonal bone marrow plasma cells greater than or equal to 10% or biopsy-proven bony or extramedullary plasmacytoma[1] and any one or more of the following myeloma defining events:

- Evidence of end organ damage that can be attributed to the underlying plasma cell proliferative disorder, specifically:
  - Hypercalcemia: serum calcium greater than 0.25 mmol/L (greater than 1 mg/dL) higher than the upper limit of normal or greater than 2.75 mmol/L (greater than 11 mg/dL)
  - Renal insufficiency: CrCl less than 40 mL per minute or serum creatinine greater than 177 µmol/L (greater than 2 mg/dL)
  - Anemia: hemoglobin value of greater than 20 g/L below the lower limit of normal, or a hemoglobin value less than 100 g/L
  - Bone lesions: one or more osteolytic lesions on skeletal radiography, CT, or PET/CT[2]
- Any one or more of the following biomarkers of malignancy:
  - Clonal bone marrow plasma cell percentage[1] greater than or equal to 60%
  - Involved:uninvolved serum free light chain ratio[3] greater than or equal to 100
  - Greater than 1 focal lesions on MRI studies[4]

[1] Clonality should be established by showing k/λ-light-chain restriction on flow cytometry, immunohistochemistry, or immunofluorescence. Bone marrow plasma cell percentage should preferable be estimated from a core biopsy specimen; in case of a disparity between the aspirate and core biopsy, the highest value should be used.

[2] If bone marrow has less than 10% clonal plasma cells, more than one bone lesion is required to distinguish from solitary plasmacytoma with minimal marrow involvement

[3] These values are based on the serum Freelite assay (The Binding Site Group, Birminham, UK). The involved free light chain must be greater than or equal to 100 mg/L.

[4] Each focal lesion must be 5 mm or more in size

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APPENDIX B: Treatment

Induction Therapy for Stem Cell Transplant Candidates:

Preferred treatments:
- Carfilzomib/lenalidomide/dexamethasone
- Bortezomib/lenalidomide/dexamethasone
- Carfilzomib/cyclophosphamide/dexamethasone
- Bortezomib/cyclophosphamide/dexamethasone

Others:
- Carfilzomib/dexamethasone
- Bortezomib/dexamethasone
- Lenalidomide/dexamethasone

Special considerations:
- If neuropathy, consider lenalidomide/dexamethasone containing therapy or carfilzomib containing regimen
- If renal impairment:
  - Dose reduce lenalidomide according to guidelines
  - Use carfilzomib with caution; close renal monitoring is warranted
- Check 2D echocardiogram or equivalent prior to use of carfilzomib to ensure adequate baseline ejection fraction (EF)
- If diabetic, consider low-dose dexamethasone-based combination therapy and consultation to Endocrinology–Diabetes for diabetes management

Primary Treatment for Non-Stem Cell Transplant Candidates:
- Consider treatments indicated for stem cell transplant candidates plus ixazomib/lenalidomide/dexamethasone

Consolidation/Maintenance Therapy:
- Carfilzomib/lenalidomide/dexamethasone
- Ixazomib/lenalidomide/dexamethasone
- Bortezomib/lenalidomide/dexamethasone
- Lenalidomide
- Ixazomib
- Bortezomib

Salvage Therapy:
- Bendamustine/bortezomib/dexamethasone
- Bendamustine/lenalidomideb/dexamethasone
- Bortezomib/cyclphosphamide/dexamethasone
- Bortezomib/lenalidomide/dexamethasone
- Bortezomib/liposomal doxorubicin/dexamethasone
- Carfilzomib/bendamustine/dexamethasone
- Carfilzomib/cyclophosphamide/dexamethasone
- Carfilzomib (twice weekly)/dexamethasone
- Carfilzomib (weekly)/dexamethasone
- Carfilzomib/lenalidomide/dexamethasone
- Cyclophosphamide/lenalidomide/dexamethasone
- Daratumumab
- Daratumumab/bortezomib/dexamethasone
- Daratumumab/lenalidomide/dexamethasone
- Daratumumab/pomalidomide[1]/dexamethasone
- Elotuzumab/bortezomib/dexamethasone
- Elotuzumab/lenalidomide/dexamethasone
- Ixazomib/dexamethasone
- Ixazomib/lenalidomide/dexamethasone
- Ixazomib/pomalidomide[1]/dexamethasone
- Lenalodimide/dexamethasone
- Panobinostat/bortezomib/dexamethasone
- Panobinostat/carfilzomib
- Panobinostat/lenalidomide/dexamethasone
- Pomalidomide[1]/bortezomib/dexamethasone
- Pomalidomide[1]/carfilzomib/dexamethasone
- Pomalidomide[1]/cyclophosphamide/dexamethasone
- Pomalidomide[1]/dexamethasone
- Pomalidomide[1]/elotuzumab/dexamethasone

Consider in aggressive disease:
- Dexamethasone/thalidomide/cisplatin/doxorubicin/cyclophosphamide/etoposide (DT-PACE) with or without bortezomib (VTD-PACE)
- Modified hyperfractionated cyclophosphamide/bortezomib/doxorubicin/dexamethasone
- Proteasome inhibitor and immunomodulator combination for high risk disease

[1] Two prior therapies should include proteasome inhibitor and lenalodimide agent and have disease progression on or within 60 days of last therapy

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APPENDIX C: Adjunctive Treatment

Bone Disease:

- Prior to starting bisphosphonate/denosumab:
  - Comprehensive dental exam plus appropriate dentistry prior to treatment
  - Treatment and resolution of active oral infections prior to treatment
  - Check 25-hydroxyvitamin D and corrected serum calcium levels and supplement as needed

Monoclonal Antibodies (denosumab) – Preferred

For prevention of skeletal-related events:

- Denosumab 120 mg SQ every 4 weeks
- Monitoring during therapy:
  - Check serum creatinine, calcium, phosphorus and magnesium during the first weeks of therapy initiation
- CrCl less than 30 mL/minute: use is not recommended[1]

Bisphosphonates (pamidronate and zoledronic acid)

- Zoledronic acid 4 mg every 3 months (preferred) and pamidronate 90 mg once monthly for 2 years, then re-evaluate. If skeletal related event (SRE) occurs, reinstitute treatment.
- All patients treated with bisphosphonate should receive a greater than or equal to 2 hour infusion of pamidronate and greater than or equal to 15 minute infusion of zoledronic acid.
- Renal impairment dose adjustments:
  - Zoledronic acid
    - CrCl 50 - 60 mL/minute: reduce dose to 3.5 mg
    - CrCl 40 - 49 mL/minute: reduce dose to 3.3 mg
    - CrCl 30 - 39 mL/minute: reduce dose to 3 mg
    - CrCl less than 30 mL/minute: use is not recommended
  - Pamidronate - consider dose reduction to 30 mg – 60 mg if creatinine greater than 3 mg/dL or creatinine clearance less than 30 mL/minute

Bone Disease – continued

- Monitoring during therapy:
  - Check creatinine prior to each infusion (hold bisphosphonate if creatinine has risen greater than or equal to 0.5 mg/dL change or twice the baseline value if original creatinine was less than 1.4 mg/dL)
  - Every 3-6 months check for albuminuria; if greater than 500 mg/24 hours hold treatment until return to baseline. If reinitiating, infuse zoledronic acid over 30 minutes and pamidronate over 4 hours.
- Discontinue bisphosphonates if osteonecrosis of the jaw develops

Infection:

- Intravenous immunoglobulin therapy should be considered in the setting of recurrent life-threatening infection, hypogammaglobulinemia, and/or if greater than or equal to 3 infections/year
- Consider pneumococcal vaccinations (PCV13 and PPSV23) per CDC guidelines
- Consider annual influenza vaccine
  - Consider high-dose influenza vaccine for patients greater than or equal to 65 years old and patients who have previously undergone a SCT
- Herpes zoster prophylaxis is indicated for patients treated with proteasome inhibitors, daratumumab, and/or high dose dexamethasone
  - Consider use in patients receiving elotuzumab
- Consider avoiding concomitant quinolone therapy for patients on bortezomib-containing regimens
- Antifungal, antibacterial, and anti-zoster prophylaxis is indicated for patients receiving hyperfractionated cyclophosphamide-based therapy
- See Appendix F for post-transplant infection prophylaxis and vaccination schedule

CDC = Centers for Disease Control and Prevention
PCV13 = pneumococcal conjugate vaccine
PPSV23 = pneumococcal polysaccharide vaccine

[1] Patients with CrCl less than 30 mL/minute were excluded in myeloma studies

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APPENDIX C: Adjunctive Treatment - continued

Renal Dysfunction:
- Maintain hydration to avoid renal failure
- Avoid use of nonsteroidal anti-inflammatory drugs (NSAID)
- Avoid gadolinium if creatinine clearance less than 30 mL/minute
- Avoid iodine IV contrast

Coagulation/thrombosis:
- Patients receiving thalidomide, lenalidomide, or pomalidomide and dexamethasone and/or anthracyclines should be given appropriate thromboprophylaxis according to the International Myeloma Working Group Guideline

Hypercalcemia:
- Prompt treatment with steroid containing chemotherapy
- Hydration, furosemide, and/or calcitonin
- Bisphosphonates
  - Dose adjustments for renal impairment not required

Symptomatic Hyperviscosity:
- Plasmapheresis should be used as adjunctive therapy

GI Prophylaxis:
- Patients receiving steroids should receive prophylaxis with a proton pump inhibitor or H_2-receptor antagonist

Radiation Therapy:
- Low-dose radiation therapy (20-30 Gy) can be used as palliative treatment for uncontrolled pain, impending or overt pathologic fracture, and/or impending or overt cord compression
- Limited involved sites should be used to decrease the impact of radiation on stem-cell harvest and potential future treatments

Orthopedic or Neurosurgical:
- Consider vertebroplasty or kyphoplasty for symptomatic vertebral compression fractures
- Consultation with orthopedic surgery should be sought as appropriate for impending or overt long bone fractures
- Consultation with neurosurgery should be sought in the setting of impending or overt spinal cord compression or vertebral column instability

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APPENDIX D: Response Criteria for Multiple Myeloma

Standard IMWG Criteria	Response Criteria
Stringent complete response	• Complete response as defined below plus normal FLC ratio and absence of clonal cells in bone marrow biopsy by immunohistochemistry (k/λ ratio less than or equal to 4:1 or greater than or equal to 1:2 for k and λ patients, respectively, after counting greater than or equal to 100 plasma cells)
Complete response	• Negative immunofixation on the serum and urine and disappearance of any soft tissue plasmacytomas and less than 5% plasma cells in bone marrow aspirates
Very good partial response	• Serum and urine M-protein detectable by immunofixation but not on electrophoresis or greater than or equal to 90% reduction in serum M-protein plus urine M-protein level less than 100 mg per 24 hours
Partial response	• Greater than or equal to 50% reduction of serum M-protein plus reduction in 24 hour urinary M-protein by greater than or equal to 90% or to less than 200 mg per 24 hours • If the serum and urine M-protein are unmeasurable, a greater than or equal to 50% decrease in the difference between involved and uninvolved FLC levels is required in place of the M-protein criteria • If serum and urine M-protein are unmeasurable, and serum-free light assay is also unmeasureable, greater than or equal to 50% reduction in plasma cells is required in place of M-protein, provided baseline bone marrow plasma-cell percentage was greater than or equal to 30%. In addition to these criteria, if present at baseline, a greater than or equal to 50% reduction in the size (SPD) of soft tissue plasmacytomas is also required.
Minimal response	• Greater than or equal to 25% but less than or equal to 49% reduction of serum M-protein and reduction in 24 hour urine M-protein by 50-89%. In addition to the above listed criteria, if present at baseline, a greater than or equal to 50% reduction in the size (SPD) of soft tissue plasmacytomas is also required.
Stable disease	• Not recommended for use as an indicator of response; stability of disease is best described by providing the time-to-progression estimates. Not meeting criteria for complete response, very good partial response, partial response, minimal response, or progressive disease.

IMWG = International Myeloma Working Group
SPD = sum of the produce of the maximal perpendicular diameters of measured lesions

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APPENDIX D: Response Criteria for Multiple Myeloma - continued

Standard IMWG Criteria	Response Criteria
Progressive disease	Any one or more of the following criteria: • Increase of 25% from lowest confirmed response value in one or more of the following criteria: ◦ Serum M-protein (absolute increase must be greater than or equal to 0.5 g/dL) ◦ Serum M-protein increase greater than or equal to 1 g/dL, if the lowest M component was greater than or equal to 5g/dL ◦ Urine M-protein (absolute increase must be greater than or equal to 200 mg/24 hour) ◦ In patients without measurable serum and urine M-protein levels, the difference between involved and uninvolved FLC levels (absolute increase must be greater than 10 mg/dL) ◦ In patients without measurable serum and urine M-protein levels and without measurable involved FLC levels, bone marrow plasma cell percentage irrespective of baseline status (absolute increase must be greater than or equal to 10%) • Appearance of a new lesion(s), greater than or equal to 50% increase from nadir in SPD of greater than 1 lesion, or greater than or equal to 50% decrease in the longest diameter of a previous lesion greater than 1 cm in short axis • Greater than or equal to 50% increase in circulating plasma cells (minimum of 200 cells per µL) if this is the only measure of disease
Clinical relapse	Clinical relapse requires one or more of the following criteria: Direct indicators of increasing disease and/or end organ dysfunction (CRAB features) related to the underlying clonal plasma-cell proliferative disorder. It is not used in calculation of time to progression-free survival but is listed as something that can be reported optionally or for use in clinical practices: • Development of new soft tissue plasmacytomas or bone lesions (osteoporotic fractures do not constitute progression) • Definite increase in the size of existing plasmacytomas or bone lesions. A definite increase is defined as a 50% (and greater than or equal to 1 cm) increase as measured serially buy the SPD of the measurable lesion • Hyperviscosity related to serum paraprotein
Relapse from complete response (to be used only if the end point is disease-free survival	Any one or more of the following criteria: • Reappearance of serum or urine M-protein by immunofixation or electrophoresis • Development of greater than or equal to 5% plasma cells in the bone marrow • Appearance of any other sign of progression (i.e., new plasmacytoma, lytic bone lesions, or hypercalcaemia see above)
Relapse from MRD negative (to be used only if the end point is disease-free survival	Any one or more of the following criteria: • Loss of MRD negative state (evidence of clonal plasma cells on NGF or NGS or positive imaging study for recurrence of myeloma) • Reappearance of serum or urine M-protein by immunofixation or electrophoresis • Development of greater than or equal to 5% clonal plasma cells in the bone marrow • Appearance of any other sign of progression (i.e., new plasmacytoma, lytic bone lesion, or hypercalaemia)

CRAB features = calcium elevation, renal failure, anaemia, lytic bone lesions

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APPENDIX D: Response Criteria for Multiple Myeloma - continued

IMWG MRD Criteria	Response Criteria
Sustained MRD-negative	• MRD negativity in the marrow (NGF or NGS or both) and by imaging as defined below, confirmed minimum of 1 year apart. Subsequent evaluations can be used to further specify the duration of negativity (e.g., MRD-negative at 5 years).
Flow MRD-negative	• Absence of phenotypically aberrant clonal plasma cells by NGF on bone marrow aspirate using the EuroFlow standard operation procedure for MRD detection in multiple myeloma (or validated equivalent method) with a minimum sensitivity of 1 in 10^5 nucleated cells or higher
Sequencing MRD-negative	• Absence of clonal plasma cells by NGS on bone marrow aspirate in which presence of a clone is defined as less than two identical sequencing reads obtained after DNA sequencing of bone marrow aspirates using the LymphoSIGHT platform (or validated equivalent method) with a minimum sensitivity of 1 in 10 nucleated cells or higher
Imaging plus MRD-negative	• MRD negativity as defined by NGF or NGS plus disappearance of every area of increased tracer uptake found at baseline or a preceding PET/CT or decrease to less mediastinal blood pool SUV or decrease to less than that of surrounding normal tissue

MRD = minimal residual disease
NGF = next-generation flow
NGS = next-generation sequencing
SUV = maximum standardized uptake value

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APPENDIX E: Considerations For Undergoing Autologus SCT

Clinical Eligibility Criteria

- No uncontrolled cardio/pulmonary conditions
- Adequate peripheral venous access or adequate option for central venous access for autologous apheresis donors
- Negative pregnancy test for women of child-bearing potential
- No known allergy to cytokines if cytokines are to be used
- Patients with sickle cell anemia and other hemoglobinopathies are candidates for autologous stem cell transplant as long as their clinical condition permits the collection of sufficient stem cells
- Labs:
  - WBC - recommend greater than 3 K/microliter (minimum greater than 2 K/microliter)
  - Platelets - recommend greater than 75 K/microliter (minimum greater than 50 K/microliter)
- Negative pregnancy test for women of child-bearing potential
- No known allergy to cytokines if cytokines are to be used

Clinical Suitability Criteria

- Durie Salmon stage (should be II or III to qualify)
- Partial response to prior therapy (defined as a 50% decrease either in measurable serum and/or paraprotein or in bone marrow infiltration sustained for at least one month)
- Adequate cardiac, renal, pulmonary, and hepatic function

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APPENDIX F: Post-SCT Infection Prophylaxis and Vaccination Schedule (Adults)

Antibacterial Prophylaxis

- Levofloxacin 500 mg IV/PO once daily, starting Day -1 or if patient neutropenic at start of chemotherapy/admission (ANC less than or equal to 1 K/microliter)
  - Continue until ANC is greater than 1 K/microliter after engraftment or until patient becomes febrile
  - Adjust dose for CrCl less than 50 mL/minute
- Alternative options (*i.e.*, allergy or intolerance to fluoroquinolones)
  - Cefpodoxime 200 mg PO twice daily, starting Day -1 or if patient neutropenic at start of chemotherapy/admission (ANC less than or equal to 1 K/microliter)

Antifungal Prophylaxis

- Fluconzaole 400 mg PO/IV daily from Day -1 until engraftment
- Alternative options (*i.e.*, allergy or intolerance to azoles)
  - Caspofungin 50 mg IV once daily
- Prior history of mold infection:
  - Voriconazole 200 mg PO twice daily
  - Posaconazole 300 mg PO once daily

PCP Prophylaxis

Start by engraftment (Day +30 and ANC greater than 1.5 K/microliter) and continue for at least 6 months after transplant

- First line option: sulfamethoxazole/trimethoprim (Bactrim)
  Consider initiation of folic acid 1 mg PO once daily when patients started on Bactrim prophylaxis
  - Bactrim DS (800/160 mg) 1 tablet PO daily on Monday, Wednesday, and Friday **or**
  - Bactrim SS (400/80 mg) 1 tablet PO daily **or**
  - Bactrim DS (800/160 mg) 1 tablet PO daily (reserve for patients with history of toxoplasmosis, history of toxoplasmosis IgG positive, or PCP)
- Second line options (if sulfa intolerant):
  Consider sulfamethoxazole/trimethoprim desensitization in patients with mild rash or unknown reaction to sulfa
  - Inhaled pentamidine 300 mg every 21-28 days via Respirgard II nebulizer
  - Pentamidine 4 mg/kg IV over 90 minutes every 21 days
  - Atovaquone 1500 mg PO once daily
  - Dapsone 100 mg PO once daily
    - Test for G6PD deficiency prior to initiation of therapy
    - Avoid if history of life threatening reaction to sulfamethoxazole/trimethoprim

Antiviral Prophylaxis

- Herpes simplex virus (HSV)
  - Valacyclovir 500 mg PO daily starting Day -1 and continue for 6-12 months after transplant
  - Alternative option: acyclovir 400 mg PO twice daily
  - If patient unable to take medications by mouth:
    - Acyclovir 250 mg/m^2 or 5 mg/kg IV every 12 hours
    - Patients with severe mucositis: acyclovir 250 mg/m^2 or 5 mg/kg IV every 8 hours
  - Adjust for renal impairment
- Varicella zoster virus (VZV)
  Patients with a history of shingles or VZV seropositive
  - Valacyclovir 500 mg PO twice daily, starting Day -1 for 1 year
  - Alternative option: acyclovir 800 mg PO twice daily
  - If patient unable to take medications by mouth: acyclovir 250 mg/m^2 or 5 mg/kg IV every 8 hours

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APPENDIX F: Post-SCT Infection Prophylaxis and Vaccination Schedule (Adults) - continued

Vaccine	Dose/Route	Time Post Transplant					
		6 months	8 to 9 months	12 months	14 months	18 months	Greater than or equal to 24 months
Pneumococcal conjugate (PCV, Prevnar 13®)	0.5 mL IM	X	X	X		X (if GVHD)	
Pneumococcal polysaccharide (PPSV23, Pneumovax®)	0.5 mL SC or IM					X (if no GVHD)	
Haemophilus influenzae (Hib)	0.5 mL IM	X	X	X			
Diphtheria, tetanus, acellular pertussis (DTaP)[1,2]	0.5 mL IM	X	X	X			
Inactive polio (IPV)[2]	0.5 mL SC or IM	X	X	X			
Hepatitis B (HepB)	• Less than or equal to 19 years: 0.5 mL IM • Greater than or equal to 20 years: 1 mL IM	X	X	X			
Seasonal influenza[3] (September to January/February)	• 6-35 months: 0.25 mL IM • Greater than or equal to 3 years: 0.5 mL IM	X					

[1] May substitute Tdap if DTaP unavailable
[2] DTaP and IPV may be given via the combination Kinrix® at the same intervals per chart above
[3] Continue yearly for life

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APPENDIX F: Post-SCT Infection Prophylaxis and Vaccination Schedule (Adults) - continued

Optional Vaccines[1]

Vaccine	Dose/Route	Time Post Transplant					
		6 months	8 to 9 months	12 months	14 months	18 months	Greater than or equal to 24 months
Measles, mumps, and rubella (MMR – *live vaccine*)	0.5 mL SC	Contraindicated in patients less than 24 months post-SCT, on immunosuppression, and/or active GVHD					X
Varicella virus vaccine[2] (Varivax® – *live vaccine*)	0.5 mL SC						X
Human papilloma virus[3] (HPV, Gardasil 9®)	0.5 mL IM			X	X		X
Meningococcal conjugate vaccine (MCV4, Menactra®)	0.5 mL IM			X			
Meningococcal type B vaccine (Bexsero®)	0.5 mL IM			X[4]			
Hepatitis A (Havrix®)	• Less than or equal to 18 years: 0.5 mL IM • Greater than or equal to 19 years: 1 mL IM				X		X

[1] For live attenuated vaccines, patients must be greater than 2 years post SCT, greater than 1 year off immunosuppression, and greater than 8 months since IVIG
[2] At the present, there is insufficient data to recommend the new recombinant varicella zoster vaccine (Shingrix®). Use is unlikely to be harmful and more evaluation is currently underway.
[3] For male and female patients age 9 to 26 years
[4] Two doses 4 weeks apart

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SUGGESTED READINGS

The following is not meant to be a comprehensive list of available effective treatments for myeloma. Myeloma treatments are changing rapidly and new treatments and added information regarding previous treatment treatments are available frequently. As a result, updates should be taken into consideration and for similar reasons, regimens reported only by abstract have been included on this reference list.

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