Medical Policy

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***Current Policy Effective Date: 1/1/13**
(See policy history boxes for previous effective dates)

Title: BMT - Hematopoietic Stem-Cell Transplantation for Non-Hodgkin Lymphomas

Description / Background

Hematopoietic Stem-Cell Transplantation
Hematopoietic stem-cell transplantation (HSCT) refers to a procedure in which hematopoietic stem cells are infused to restore bone marrow function in cancer patients who receive bone-marrow-toxic doses of cytotoxic drugs, with or without whole-body radiation therapy. Hematopoietic stem cells may be obtained from the transplant recipient (autologous HSCT) or from a donor (allogeneic HSCT). They can be harvested from bone marrow, peripheral blood, or umbilical cord blood shortly after delivery of neonates. Although cord blood is an allogeneic source, the stem cells in it are antigenically “naïve” and thus are associated with a lower incidence of rejection or graft-versus-host disease (GVHD).

Immunologic compatibility between infused hematopoietic stem cells and the recipient is not an issue in autologous HSCT. However, immunologic compatibility between donor and patient is a critical factor for achieving a good outcome of allogeneic HSCT. Compatibility is established by typing of human leukocyte antigens (HLA) using cellular, serologic, or molecular techniques. HLA refers to the tissue type expressed at the Class I and Class II loci on chromosome 6. Depending on the disease being treated, an acceptable donor will match the patient at all or most of the HLA loci (with the exception of umbilical cord blood).

Conventional Preparative Conditioning for HSCT
The success of autologous HSCT is predicated on the ability of cytotoxic chemotherapy with or without radiation to eradicate cancerous cells from the blood and bone marrow. This permits subsequent engraftment and repopulation of bone marrow space with presumably normal hematopoietic stem cells obtained from the patient prior to undergoing bone marrow ablation. As a consequence, autologous HSCT is typically performed as consolidation therapy when the patient’s disease is in complete remission. Patients who undergo autologous HSCT are

susceptible to chemotherapy-related toxicities and opportunistic infections prior to engraftment, but not GVHD.

The conventional ("classical") practice of allogeneic HSCT involves administration of cytotoxic agents (e.g., cyclophosphamide, busulfan) with or without total-body irradiation at doses sufficient to destroy endogenous hematopoietic capability in the recipient. The beneficial treatment effect in this procedure is due to a combination of initial eradication of malignant cells and subsequent graft-versus-malignancy (GVM) effect mediated by nonself immunologic effector cells that develop after engraftment of allogeneic stem cells within the patient's bone marrow space. While the slower GVM effect is considered to be the potentially curative component, it may be overwhelmed by extant disease without the use of pretransplant conditioning. However, intense conditioning regimens are limited to patients who are sufficiently fit medically to tolerate substantial adverse effects that include pre-engraftment opportunistic infections secondary to loss of endogenous bone marrow function and organ damage and failure caused by the cytotoxic drugs. Furthermore, in any allogeneic HSCT, immune suppressant drugs are required to minimize graft rejection and GVHD, which also increases susceptibility of the patient to opportunistic infections.

Reduced-Intensity Conditioning for Allogeneic HSCT

Reduced-intensity conditioning (RIC) refers to the pretransplant use of lower doses or less intense regimens of cytotoxic drugs or radiation than are used in traditional full-dose myeloablative conditioning treatments. The goal of RIC is to reduce disease burden but also to minimize as much as possible associated treatment-related morbidity and non-relapse mortality (NRM) in the period during which the beneficial GVM effect of allogeneic transplantation develops. Although the definition of RIC remains arbitrary, with numerous versions employed, all seek to balance the competing effects of NRM and relapse due to residual disease. RIC regimens can be viewed as a continuum in effects, from nearly totally myeloablative to minimally myeloablative with lymphoablation, with intensity tailored to specific diseases and patient condition. Patients who undergo RIC with allogeneic HSCT initially demonstrate donor cell engraftment and bone marrow mixed chimerism. Most will subsequently convert to full-donor chimerism, which may be supplemented with donor lymphocyte infusions to eradicate residual malignant cells.

For the purposes of this Policy, the term "reduced-intensity conditioning" will refer to all conditioning regimens intended to be nonmyeloablative, as opposed to fully myeloablative (traditional) regimens.

Non-Hodgkin Lymphoma (NHL)

A heterogeneous group of lymphoproliferative malignancies, NHL usually originates in lymphoid tissue. Historically, uniform treatment of patients with NHL was hampered by the lack of a uniform classification system. In 1982, the Working Formulation (WF) was developed to unify different classification systems into one. (1) The WF divided NHL into low-, intermediate-, and high-grade, with subgroups based on histologic cell type. Since our understanding of NHL has improved, the diagnosis has become more sophisticated and includes the incorporation of new immunophenotyping and genetic techniques. As a result, the WF has become outdated.

European and American pathologists proposed a new classification, the Revised European-American Lymphoma (REAL) Classification (2) and an updated version of the REAL system, the new World Health Organization (WHO) classification. (3) The WHO/REAL classification

recognized 3 major categories of lymphoid malignancies based on morphology and cell lineage: B-cell neoplasms, T-cell/natural killer (NK)-cell neoplasms, and Hodgkin lymphoma.

The most recent lymphoma classification is the 2008 WHO classification:

Updated WHO Classification 2008 (4)
<u>Mature B-cell neoplasms</u>

- Chronic lymphocytic leukemia/small lymphocytic lymphoma
- B-cell prolymphocytic leukemia
- Splenic marginal zone lymphoma
- Hairy cell leukemia
- *Splenic lymphoma/leukemia, unclassifiable*
  - *Splenic diffuse red pulp small B-cell lymphoma**
  - *Hairy cell leukemia-variant**
- Lymphoplasmacytic lymphoma
  - Waldenstrom macroglobulinemia
- Heavy chain diseases
  - Alpha heavy chain disease
  - Gamma heavy chain disease
  - Mu heavy chain disease
- Plasma cell myeloma
- Solitary plasmacytoma of bone
- Extraosseous plasmacytoma
- Extranodal marginal zone B-cell lymphoma of mucosa-associated lymphoid tissue (MALT lymphoma)
- Nodal marginal zone B-cell lymphoma (MZL)
  - *Pediatric type nodal MZL*
- Follicular lymphoma
  - Pediatric type follicular lymphoma
- Primary cutaneous follicle center lymphoma
- Mantle cell lymphoma
- Diffuse large B-cell lymphoma (DLBCL), not otherwise specified
  - T cell/histiocyte rich large B-cell lymphoma
  - *DLBCL associated with chronic inflammation*
  - *Epstein-Barr virus (EBV)+ DLBCL of the elderly*
- Lymphomatoid granulomatosis
- Primary mediastinal (thymic) large B-cell lymphoma
- Intravascular large B-cell lymphoma
- *Primary cutaneous DLBCL, leg type*
- ALK [anaplastic lymphoma kinase] + large B-cell lymphoma
- Plasmablastic lymphoma
- Primary effusion lymphoma
- *Large B-cell lymphoma arising in HHV8-associated multicentric Castleman disease*
- Burkitt lymphoma
- *B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma and Burkitt lymphoma*
- B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma and classical Hodgkin lymphoma

*These represent provisional entities or provisional subtypes of other neoplasms.

Diseases shown in *italics* are newly included in the 2008 WHO classification.

Mature T-cell and NK-cell neoplasms

- T-cell prolymphocytic leukemia
- T-cell large granular lymphocytic leukemia
- Chronic lymphoproliferative disorder of NK-cells*
- Aggressive NK-cell leukemia
- *Systemic EBV* [Epstein-Bar virus]+ *T-cell lymphoproliferative disease of childhood (associated with chronic active EBV infection)*
- *Hydroa vacciniforme-like lymphoma*
- Adult T-cell leukemia/ lymphoma
- Extranodal NK/T cell lymphoma, nasal type
- Enteropathy-*associated* T-cell lymphoma
- Hepatosplenic T-cell lymphoma
- Subcutaneous panniculitis-like T-cell lymphoma
- Mycosis fungoides
- Sézary syndrome
- Primary cutaneous CD30+ T-cell lymphoproliferative disorder
  - Lymphomatoid papulosis
  - Primary cutaneous anaplastic large-cell lymphoma
- *Primary cutaneous aggressive epidermotropic CD8+ cytotoxic T-cell lymphoma**
- *Primary cutaneous gamma-delta T-cell lymphoma*
- *Primary cutaneous small/medium CD4+ T-cell lymphoma**
- Peripheral T-cell lymphoma, not otherwise specified
- Angioimmunoblastic T-cell lymphoma
- Anaplastic large cell lymphoma (ALCL), ALK+
- Anaplastic large cell lymphoma (ALCL), ALK–*

*These represent provisional entities or provisional subtypes of other neoplasms.

Diseases shown in *italics* are newly included in the 2008 WHO classification.

In the U.S., B-cell lymphomas represent 80–85% of cases of NHL, and T-cell lymphomas represent 15–20%. NK (natural killer) lymphomas are relatively rare. (5)

The International Lymphoma Classification Project identified the most common NHL subtypes as follows: diffuse large B-cell lymphoma (DLBCL) 31%, follicular lymphoma (FL) 22%, small lymphocytic lymphoma/chronic lymphocytic leukemia (SLL/CLL) 6%, mantle cell lymphoma (MCL) 6%, peripheral T-cell lymphoma (PTCL) 6%, and marginal zone B-cell lymphoma/mucosa-associated lymphoid tissue (MALT) lymphoma 5%. All other subtypes each represent less than 2% of cases of NHL. (5)

In general, the NHL can be divided into two prognostic groups, indolent and aggressive. Indolent NHL has a relatively good prognosis, with a median survival of 10 years; however, it is not curable in advanced clinical stages. (1) Early stage indolent NHL (stage 1 or 2) may be effectively treated with radiation alone. (1) Although indolent NHL is responsive to radiation and chemotherapy, a continuous rate of relapse is seen in advanced stages. (1) These patients can often be re-treated if their disease remains of the indolent type. Indolent NHL may transform into a more aggressive form, which is generally treated with regimens that are used for aggressive, recurrent NHL. Histologic transformation to higher grade lymphoma occurs in up to

70% of patients with low-grade lymphoma, (6) and median survival with conventional chemotherapy is 1 year or less.

FL (follicular lymphoma) is the most common indolent NHL (70–80% of cases), and often the terms indolent lymphoma and FL are used synonymously. Also included in the indolent NHL are SLL/CLL, lymphoplasmacytic lymphoma, marginal zone lymphomas, and cutaneous T-cell lymphoma.

Aggressive NHL has a shorter natural history; however, 30–60% of these patients can be cured with intensive combination chemotherapy regimens. (1) Aggressive lymphomas include DLBCL, MCL, PTCL, anaplastic large cell lymphoma, and Burkitt lymphoma.

Oncologists developed a clinical tool to aid in predicting the prognosis of patients with aggressive NHL (specifically DLBCL), referred to as the **International Prognostic Index** (IPI). (7) Prior to the development of IPI in 1993, prognosis was predominantly based on disease stage.

The IPI defines 4 risk groups based on the number of risk factors present and adjusted for patient age:
1. Low
2. Low intermediate
3. High intermediate
4. High risk

…..and lists 5 significant risk factors prognostic of overall survival (OS), which include:
1. Age older than 60 years
2. Elevated serum lactate dehydrogenase (LDH) level
3. Ann Arbor stage III or IV disease
4. Eastern Cooperative Oncology Group (ECOG) performance status of 2, 3, or 4
5. Involvement of more than 1 extranodal site

Risk groups are stratified according to the number of adverse factors as follows: 0 or 1 is low risk, 2 is low intermediate, 3 is high intermediate, and 4 or 5 are high risk.

Patients with 2 or more risk factors have a less than 50% chance of relapse-free survival (RFS) and OS at 5 years. Age-adjusted (aaIPI) and stage-adjusted modifications of this IPI are used for younger patients with localized disease.

Adverse risk factors for age-adjusted IPI include stage III or IV disease, elevated LDH and ECOG performance status of 2 or greater and can be calculated as follows: 0 is low risk, 1 is low intermediate, 2 is high intermediate and 3 is high risk.

With the success of the IPI, a separate prognostic index was developed for FL, which has multiple independent risk factors for relapse after a first complete remission. The proposed and validated Follicular Lymphoma International Prognostic Index (FLIPI) contains 5 adverse prognostic factors:
1. Age older than 60 years
2. Ann Arbor stage III–IV
3. Hemoglobin level less than 12.0 g/dL
4. More than 4 lymph node areas involved

5. Elevated serum lactate dehydrogenase (LDH) level

These 5 factors are used to stratify patients into 3 categories of risk: low (0–1 risk factor), intermediate (2 risk factors), or poor (3 or more risk factors). (8)

Mantle Cell Lymphoma (MCL)
MCL comprises approximately 6–8% of NHL and has been recognized within the past 15 years as a unique lymphoma subtype with a particularly aggressive course. MCL is characterized by a chromosomal translocation t(11;14), and the term mantle cell lymphoma was proposed in 1992 by Banks et al. (9) The number of therapeutic trials are not as numerous for MCL as for other NHL, as it was not widely recognized until the REAL classification. MCL shows a strong predilection for elderly men, and the majority of cases (70%) present with disseminated (stage 4) disease and extranodal involvement is common. Localized MCL is quite rare. MCL has a median survival of approximately 2–4 years, and although most patients achieve remission with first-line therapy, relapse inevitably occurs, often within 12–18 months. MCL is rarely, if ever, cured with conventional therapy, and no standardized therapeutic approach to MCL is used.

There had been no generally established prognostic index for patients with MCL. Application of the IPI or FLIPI system to patients with MCL showed limitations, which included no separation of some important risk groups. In addition, some of the individual IPI and FLIPI risk factors, including number of extranodal sites and number of involved nodal areas showed no prognostic relevance, and hemoglobin showed no independent prognostic relevance in patients with MCL. (10) Therefore, a new prognostic index for patients with MCL was developed and should prove useful in comparing clinical trial results for MCL.

MCL international prognostic index (MIPI):
1. Age
2. ECOG performance status
3. Serum LDH (calculated as a ratio of LDH to a laboratory's upper limit of normal)
4. White blood cell count (WBC)
    - Zero points each are assigned for age younger than 50 years, ECOG performance 0–1, LDH ratio less than 0.67, WBC less than 6,700
    - One point each for age 50–59 years, LDH ratio 0.67–0.99, WBC 6,700–9,999
    - Two points each for age 60–69 years, ECOG 2–4, LDH ratio 1.00–1.49, WBC 10,000–14,999
    - Three points each for age 70 years or older, LDH ratio 1.5 or greater, WBC 15,000 or more

MIPI allows separation of 3 groups with significantly different prognoses: (10):
- 0–3 points=low risk, 44% of patients, median OS not reached and a 5-year OS rate of 60%
- 4–5 points=intermediate risk, 35% of patients, median OS 51 months
- 6–11 points=high risk, 21% of patients, median OS 29 months

Peripheral T-Cell Lymphoma (PTCL)
The majority of peripheral T-cell lymphomas are aggressive and fall into the category of PTCL, unspecified (PTCL-u) or not otherwise specified (PTCL-NOS), angioimmunoblastic or anaplastic large cell which, combined make up approximately 60–70% of T-cell lymphomas. PTCLs are less responsive to standard chemotherapy than DLBCLs and carry a worse prognosis than aggressive B-cell counterparts. Survival rates at 5 years with standard

chemotherapy regimens range from 20–35%. The poor results with conventional chemotherapy have prompted exploration of the role of HSCT as therapy.

Staging
The Ann Arbor staging classification is commonly used for the staging of lymphomas and is the scheme defined in the American Joint Committee on Cancer (AJCC) Manual for Staging Cancer. Originally developed for Hodgkin's disease, this staging scheme was later expanded to include non-Hodgkin's lymphoma.

Staging of Lymphoma: Ann Arbor Classification
Stage I
Involvement of a single lymph node region (I) or of a single extralymphatic organ or site (IE)
Stage II
Involvement of 2 or more lymph node regions on the same side of the diaphragm (II) or localized involvement of extralymphatic organ or site and of one or more lymph node regions on the same side of the diaphragm (IIE).
Stage III
Involvement of lymph node regions on both sides of the diaphragm (III) which may also be accompanied by localized involvement of extralymphatic organ or site (IIIE) or by involvement of the spleen (IIIS) or both (IIISE)
Stage IV
Diffuse or disseminated involvement of one or more extralymphatic organs or tissues with or without associated lymph node enlargement.

Regulatory Status:

N/A

Medical Policy Statement

The safety and effectiveness of hematopoietic stem-cell transplantation for non-Hodgkin lymphomas has been established. It may be considered a useful therapeutic option for patients meeting specific patient selection guidelines.

Contraindications

Absolute and relative contraindications represent situations where proceeding with transplant may not be advisable in the context of limited organ/tissue availability. Contraindications may evolve over time as transplant experience grows in the medical community. Clinical documentation supplied to the health plan *must* demonstrate that attending staff at the transplant center have considered *all* contraindications as part of their overall evaluation of potential organ transplant recipients and have decided to proceed.

Relative contraindications:

The selection process for approved tissue transplants is designed to obtain the best result for each patient. Therefore, relative contraindications to HSCT may include, but are not limited to:

- Poor cardiac function: Ejection fraction should be greater than 45% with no overt symptoms of congestive heart failure.
- Poor pulmonary function: Pulmonary function tests must be greater than or equal to 50% of predicted value.
- Poor renal function: Renal creatinine clearance should be greater than 40 ml/min or creatinine must be less than or equal to 2mg/dl.
- Poor liver function: There should be no history of severe chronic liver disease
- Presence of HIV or an active form of hepatitis B, hepatitis C or human T-cell lymphotropic virus (HTLV-1).

Inclusionary and Exclusionary Guidelines (Clinically based guidelines that may support individual consideration and pre-authorization decisions)

Key: HSCT= Hematopoietic Stem Cell Transplant; CR=Complete response;

Non-Hodgkin Lymphoma (general):

- *Autologous* HSCT and *allogeneic* HSCT are considered experimental/investigational as initial therapy (i.e., without a full course of standard-dose induction chemotherapy) for any NHL.
- *Autologous* HSCT and *allogeneic* HSCT are considered experimental/investigational to consolidate* a first CR for patients with diffuse large B-cell lymphoma and an International Prognostic Index score that predicts a low- or low-intermediate risk of relapse.
  **Note: Consolidation therapy is additional high dose chemotherapy (HDC) and/or stem cell transplant or additional conventional dose chemotherapy to ensure stability of a remission.*
- Tandem transplants are considered experimental/investigational to treat patients with any stage, grade or subtype of NHL.

Non-Hodgkin lymphoma (NHL) B-cell subtypes that are considered aggressive (except mantle cell lymphoma):

Inclusions:
Allogeneic hematopoietic stem-cell transplantation (HSCT) using a myeloablative conditioning regimen or autologous HSCT (must meet one):

- As salvage therapy for patients who do not achieve a complete remission (CR) after first-line treatment (induction) with a full course of standard-dose chemotherapy;
- To achieve or consolidate* a CR for those in a chemosensitive first or subsequent relapse;
  **Note: Consolidation therapy is additional high dose chemotherapy (HDC) and/or stem cell transplant or additional conventional dose chemotherapy to ensure stability of a remission.*

Exclusions:
Patients not meeting the above guidelines.

Mantle cell lymphoma:
Inclusions:

- *Autologous* HSCT to consolidate a first remission.
- *Allogeneic* HSCT, myeloablative or reduced-intensity conditioning, when used as salvage therapy.

Exclusions:
- *Autologous* HSCT when used as salvage therapy.
- *Allogeneic* HSCT to consolidate a first remission.

<u>For patients with NHL B-cell subtypes considered indolent</u>
Inclusions:
- Either *allogeneic* HSCT using a myeloablative conditioning regimen or *autologous* HSCT when used
  - As salvage therapy for patients who do not achieve CR after first-line treatment (induction) with a full course of standard-dose chemotherapy; or
  - To achieve or consolidate CR for those in a first or subsequent chemosensitive relapse, whether or not their lymphoma has undergone transformation to a higher grade.

Exclusions:
- To consolidate* a first CR for those with indolent NHL B-cell subtypes.
  **Note: Consolidation therapy is additional high dose chemotherapy (HDC) and/or stem cell transplant or additional conventional dose chemotherapy to ensure stability of a remission.*

<u>For patients with mature T-cell or NK-cell (peripheral T-cell) neoplasms</u>
Inclusions:
- Autologous HSCT to consolidate a first complete remission in high-risk subtypes
- Autologous or allogeneic HSCT (myeloablative or reduced-intensity conditioning) as salvage therapy.

Exclusions:
- Allogeneic HSCT is considered **investigational** to consolidate a first remission.

<u>Reduced-intensity conditioning *allogeneic* HSCT</u>
Inclusions:
Treatment of NHL in patients who meet criteria for an allogeneic HSCT but who do not qualify for a myeloablative allogeneic HSCT.
Exclusions:
Those not meeting the above inclusionary guideline.

Guidelines:
- Reduced-intensity conditioning (RIC) would be considered an option in patients who meet criteria for an allogeneic hematopoietic stem-cell transplant (HSCT) but whose age (typically older than 55 years) or comorbidities (e.g., liver or kidney dysfunction, generalized debilitation, prior intensive chemotherapy) preclude use of a standard conditioning regimen.
- In patients who qualify for a myeloablative allogeneic hematopoietic HSCT on the basis of overall health and disease status, allogeneic HSCT using either myeloablative or RIC may be considered. However, a myeloablative conditioning regimen with allogeneic HSCT may benefit younger patients with good performance status and minimal comorbidities more than allogeneic HSCT with RIC.
- The term salvage therapy describes chemotherapy given to patients who have either
  - Failed to achieve complete remission after initial treatment for newly diagnosed lymphoma, or
  - Relapsed after an initial complete remission.
- A chemosensitive relapse is defined as relapsed non-Hodgkin lymphoma (NHL) that does not progress *during or immediately after* standard-dose induction chemotherapy (i.e., achieves stable disease or a partial response).

- Transformation describes a lymphoma whose histologic pattern has evolved to a higher-grade lymphoma. Transformed lymphomas typically evolve from a nodular pattern to a diffuse pattern.
- Tandem transplants usually are defined as the planned administration of 2 successive cycles of high-dose myeloablative chemotherapy, each followed by infusion of autologous hematopoietic stem cells, whether or not there is evidence of persistent disease following the first treatment cycle. Sometimes, the second cycle may use non-myeloablative immunosuppressive conditioning followed by infusion of allogeneic stem cells.

High risk (aggressive) T-cell and NK-cell neoplasms

The T-cell and NK-cell neoplasms are a clinically heterogeneous group of rare disorders, most of which have an aggressive clinical course and poor prognosis. The exception would include the following subtypes which typically have a relatively indolent and protracted course:

- T-cell large granulocyte leukemia (T-LGL)
- Chronic lymphoproliferative disorder of NK cells
- Early stage mycosis fungoides
- Primary cutaneous ALCL, and ALK+ ALCL. (11)

CPT / HCPCS Level II Codes *(Note: The inclusion of a code in this list is not a guarantee of coverage. Please refer to the medical policy statement to determine the status of a given procedure)*

Established codes:

38204	38205	38206	38208	38209	38210
38211	38212	38213	38214	38215	38220
38221	38230	38232	38240	38241	S2140
S2142	S2150				

Other codes (investigational, not medically necessary, etc.):

N/A

Rationale

This policy was initially based on 4 TEC Assessments. (12-15) Since that time, the classification of non-Hodgkin lymphoma (NHL) has undergone significant changes, and several new and unique subtypes have emerged (e.g., mantle cell lymphoma [MCL], peripheral T-cell lymphoma [PTCL]).

Indolent Lymphomas

Hematopoietic Stem-Cell Transplant (HSCT) as First-Line Treatment for Indolent Non-Hodgkin Lymphoma (NHL)

In 2008, Ladetto et al. reported the results of a Phase III, randomized, multicenter trial of patients with high-risk follicular lymphoma (FL), treated at diagnosis. (16) A total of 134 patients were enrolled to receive either rituximab-supplemented high-dose chemotherapy and autologous HSCT or 6 courses of cyclophosphamide, doxorubicin (or Adriamycin®), vincristine (Oncovin®), and prednisolone (CHOP) followed by rituximab (CHOP-R). Of these patients, 79% completed HSCT and 71% completed CHOP-R. Complete remission was 85% with

HSCT and 62% with CHOP-R. At a median follow-up of 51 months, the 4-year event-free survival (EFS) was 61% and 28% (HSCT vs. CHOP-R, respectively), with no difference in overall survival (OS). Molecular remission (defined as negative results by *polymerase chain reaction (PCR)* on 2 or more consecutive bone marrow samples spaced 6 months apart in patients who reached complete remission was achieved in 80% of HSCT and 44% of CHOP-R patients and was the strongest independent outcome predictor. In 71% of the CHOP-R patients who had a relapse, salvage HSCT was performed and achieved an 85% CR rate and a 68% 3-year EFS. The authors concluded that there was no OS advantage to treating high-risk FL initially with HSCT but that relapsed/refractory FL would be the most appropriate setting for this therapy.

In 2006, Sebban et al. reported the results of a randomized, multicenter study. (17) A total of 209 patients received cyclophosphamide, Adriamycin, etoposide, prednisolone (CHVP) plus interferon (CHVP-I arm), and 131 patients received CHOP followed by high-dose chemotherapy with total-body irradiation and autologous HSCT. Response rates were similar in both groups (79% and 78% after induction therapy, respectively). After a median follow-up of 7.5 years, intention-to-treat analysis (ITT) showed no difference between the 2 arms for OS (p=0.53) or EFS (p=0.11). The authors concluded that there was no statistically significant benefit to first-line, high-dose therapy in patients with FL and that high-dose therapy should be reserved for relapsing patients.

Deconinck and colleagues investigated the role of autologous HSCT as initial therapy in 172 patients with FL considered at high risk due to the presence of either B symptoms (i.e., weight loss, fever, or night sweats), a single lymph node larger than 7 cm, more than 3 involved nodal sites, massive splenomegaly, or a variety of other indicators of high tumor burden. (18) The patients were randomized to receive either an immunochemotherapy regimen or a high-dose therapy followed by purged autologous HSCT. While the autologous HSCT group had a higher response rate and longer median EFS, there was no significant improvement in OS rate due to an excess of secondary malignancies. The authors concluded that autologous HSCT cannot be recommended as the standard first-line treatment of FL with a high tumor burden.

In 2004, Lenz and colleagues reported on the results of a trial of 307 patients with advanced stage lymphoma in first remission, including FL, MCL, or lymphoplasmacytoid lymphoma. (19) Patients were randomized to receive either consolidative therapy with autologous HSCT or interferon therapy. The 5-year progression-free survival (PFS) rate was considerably higher in the autologous HSCT arm (64.7%) compared to the interferon arm (33.3%). However, the median follow-up of patients is still too short to allow any comparison of OS.

HSCT for Relapsed, Indolent NHL

In the majority of patients with FL relapse, and with relapsed disease, cure is very unlikely, with a median survival of 4.5 years after recurrence. (20) In the European CUP trial, 89 patients with relapsed, non-transformed FL with partial response or complete response after standard induction chemotherapy were randomized to 1 of 3 arms: 3 additional cycles of conventional chemotherapy (n=24), high-dose chemotherapy and unpurged autologous HSCT (n=33), or high-dose chemotherapy with purged autologous HSCT (n=32). (19) OS at 4 years for the chemotherapy versus unpurged versus purged arms was 46%, 71%, and 77%, respectively. Two-year progression-free survival (PFS) was 26%, 58%, and 55%, respectively. No difference was found between the 2 autologous HSCT arms. Although several studies have consistently shown improved disease-free survival (DFS) with autologous HSCT for relapsed FL, this study was the first to show a difference in OS benefit. (5)

Summary
Randomized trials have shown no survival advantage to HSCT as first-line therapy for indolent B-cell lymphomas; however, randomized studies have shown a survival benefit for relapsed disease.

Aggressive Lymphomas
HSCT for First-Line Therapy for Aggressive NHL
Several randomized trials reported on between 1997 and 2002 compared outcomes of autologous HSCT used to consolidate a first CR in patients with intermediate or aggressive non-Hodgkin lymphoma (NHL), with outcomes of an alternative strategy that delayed transplants until relapse. (21-24) As summarized in an editorial, (25) the preponderance of evidence showed that consolidating first CRs with HSCT did not improve OS for the full population of enrolled patients. However, a subgroup analysis at 8 years' median follow-up focused on 236 patients at high or high-intermediate risk of relapse (based on age-adjusted International Prognostic Index [IPI] scores) who were enrolled in the largest of these trials (the LNH87-2 protocol; reference 19). The subgroup analysis reported superior OS (64% vs. 49%, respectively; relative risk 1.51, p=0.04) and DFS (55% vs. 39%, respectively; relative risk 1.56, p=0.02) for patients at elevated risk of relapse who were consolidated with an autologous HSCT. (26)

A large, multigroup, prospective, randomized Phase III comparison of these strategies (the S9704 trial) is ongoing to confirm results of the subgroup analysis in a larger population with diffuse large B-cell lymphoma (DLBCL) at high- and high-intermediate risk of relapse. Nevertheless, many clinicians view the LNH87-2 subgroup analysis (27) as sufficient evidence to support use of autologous HSCT to consolidate a first CR when risk of relapse is high. In contrast, editorials (25,27) and recent reviews (28-30) agree that available evidence shows no survival benefit from autologous HSCT to consolidate first CR in patients with intermediate or aggressive NHL at low- or low-intermediate risk of relapse (using age-adjusted IPI score).

Between 2005 and 2008, several reports of randomized trials have shown no survival benefit to HSCT as first-line therapy for aggressive lymphomas, as summarized below:

Greb et al. undertook a systematic review and meta-analysis to determine whether high-dose chemotherapy with autologous HSCT as first-line treatment in patients with aggressive NHL improves survival compared to patients treated with conventional chemotherapy. (31) Fifteen randomized, controlled trials (RCTs) including 3,079 patients were eligible for the meta-analysis. Thirteen studies with 2,018 patients showed significantly higher CR rates in the autologous HSCT group (p=0.004). However, autologous HSCT did not have an effect on OS when compared to conventional chemotherapy. According to the IPI, subgroup analysis of prognostic groups showed no survival differences between autologous HSCT and conventional chemotherapy in 12 trials, and EFS also was not significantly different between the two groups. The authors concluded that despite higher CR rates, there is no benefit with autologous HSCT as first-line treatment in aggressive NHL.

Betticher et al. reported the results of a Phase III multicenter, randomized trial comparing sequential high-dose chemotherapy with autologous HSCT to standard CHOP as first-line therapy in 129 patients with aggressive NHL. (32) Remission rates were similar in the two groups, and after a median observation time of 48 months, there was no difference in OS with

46% in the sequential autologous HSCT group and 53% in the group that received CHOP (p=0.48). The authors concluded that sequential autologous HSCT did not confer any survival benefit as initial therapy in patients with aggressive NHL.

Baldissera et al. reported on the results of a prospective RCT comparing high-dose chemotherapy and autologous HSCT to conventional chemotherapy as frontline therapy in 56 patients with high-risk aggressive NHL. (33) The 5-year actuarial OS and PFS were not statistically different between the two study groups; only DFS was statistically different (97% vs. 47%, for the autologous HSCT and conventional groups, respectively; p=0.02.)

Olivieri et al. reported on a randomized study of 223 patients with aggressive NHL using upfront high-dose chemotherapy with autologous HSCT versus conventional chemotherapy (plus autologous HSCT in cases of failure). (34) In the conventional group, 29 patients achieved a PR or no response and went on to receive high-dose chemotherapy and autologous HSCT. With a median follow-up of 62 months, there was no difference in 7-year probability of survival (60% and 57.8%; p=0.5), DFS (62% and 71%; p=0.2), and PFS (44.9% and 40.9%; p=0.7, all respectively) between the two groups. The authors concluded that patients with aggressive NHL do not benefit from upfront autologous HSCT.

The results of the ongoing S9704 trial will likely be important in the future direction of HSCT as frontline therapy in patients with aggressive NHL and high- to high-intermediate risk of relapse.

HSCT for Relapsed, Aggressive NHL
Autologous HSCT is the treatment of choice for relapsed or refractory aggressive NHL for patients who achieve a CR or partial response (PR) with second-line therapy. (1,4) The pivotal trial establishing the superiority of autologous HSCT for relapsed DLBCL was the PARMA trial, a prospective randomized study in which 215 patients with chemosensitive disease in first or second relapse of aggressive lymphoma were given 2 courses of conventional chemotherapy. (35) One hundred and nine patients responded and were randomized to receive 4 courses of chemotherapy plus radiation (n=54) or radiotherapy plus intensive chemotherapy and autologous HSCT (n=55). The two groups did not differ in baseline characteristics. Median follow-up was 63 months. Response rate was 84% in the HSCT group, versus 44% in the non-transplant group. EFS for the transplant group was 46% versus 12% in the non-transplant group (p=0.001), and OS was 53% in the transplant group versus 32% in the non-transplant group (p=0.038).

Summary
Data from randomized trials have shown conflicting results, but some have shown a overall survival benefit with HSCT to consolidate a first CR in patients with aggressive B-cell lymphomas at high or high-intermediate risk of relapse.

HSCT for relapsed aggressive B-cell lymphomas is the treatment of choice, as randomized studies have shown an overall survival benefit with this approach.

Tandem Transplants
No prospective controlled studies comparing tandem with single transplants have been identified in the published literature.

A pilot Phase II trial evaluated tandem high-dose therapy with stem-cell support between 1994 and 1999 in 45 patients with age adjusted-IPI equal to 3 untreated aggressive non-Hodgkin's lymphoma. (36) After induction, responders underwent tandem autologous transplantation; 31 out of 41 evaluable patients completed the program. There were 4 toxic deaths. The primary end point of the study was complete response rate, which was 49%. With a median follow-up of 114 months for surviving patients, the OS was 51%, and 19 of the 22 patients (86%) who reached a complete response were alive and relapse-free. Prospective evaluation of quality of life and comorbidities of surviving patients did not reveal long-term toxicities. The authors concluded that in the era of monoclonal antibodies and response-adapted therapy, the role of tandem transplantation still needs to be determined.

A pilot study in 2005 included 41 patients with poor-risk NHL and Hodgkin's disease who were given tandem high-dose chemotherapy and autologous HSCT. (37) Thirty-one patients (76%) completed both transplants. Overall toxic death rate was 12%. The study evaluated the maximum tolerated dose of the chemotherapeutic regimen and did not compare tandem versus single transplants for NHL.

Tarella et al. reported on a multicenter, nonrandomized, prospective trial consisting of 112 patients with previously untreated DLBCL and age-adjusted IPI score of 2-3. (38) All patients received rituximab-supplemented, early-intensified high-dose chemotherapy with multiple autologous HSCT. Although the study concluded the treatment regimen improved patients' life expectancy, the comparisons were made with historic controls that had received conventional chemotherapy.

Summary
No randomized studies have been conducted on the use of tandem HSCT for the treatment of non-Hodgkin lymphomas, and the published data consist of small numbers of patients. Therefore, the data on tandem transplants is insufficient to determine outcomes with this type of treatment.

NHL Subtypes
Several subtypes have emerged with unique clinical and biologic features that will be addressed separately in the policy (specifically MCL and PTCL).

Mantle Cell Lymphoma
In an attempt to improve the outcome of mantle cell lymphoma (MCL), several Phase II trials investigated the efficacy of autologous HSCT, with published results differing substantially. (10, 39) Some studies found no benefit to HSCT, and others suggested an EFS advantage, at least in a subset of patients. (10) The differing results in these studies were likely due to different time points of transplant (first vs. second remission) and other patient selection criteria. (39)

In 2005, the results of the first randomized trial were reported by Dreyling and colleagues of the European MCL Network. (39) A total of 122 patients with MCL received either autologous HSCT or interferon as consolidation therapy in first CR or PR. Among these patients, 43% had a low-risk, 11% had a high-intermediate risk, and 6% had a high-risk profile. Autologous HSCT resulted in a PR rate of 17% and a CR rate of 81% (versus PR of 62% and CR of 37% with interferon). Survival curves for time to treatment failure (TTF) after randomization showed that autologous HSCT was superior to interferon (p=0.0023). There also was significant improvement in the 3-year PFS demonstrated in the autologous HSCT versus interferon arm

(54% and 25%, respectively; p=0.01). At the time of the reporting, no advantage was seen in OS, with a 3-year OS of 83% versus 77%. The trial also suggested that the impact of autologous HSCT could depend on the patient's remission status prior to the transplant, with a median PFS of 46 months in patients in CR versus 33 months in patients in PR.

Till et al. reported the results of the outcomes of 56 patients with MCL treated with induction chemotherapy with cyclophosphamide, vincristine, doxorubicin, and dexamethasone (hyperCVAD) with or without rituximab followed by autologous HSCT in first CR or PR (n=21), CHOP with or without rituximab followed by autologous HSCT in first CR or PR (n=15), or autologous HSCT following disease progression (n=20). (40) OS and PFS at 3 years among patients transplanted in CR or PR were 93% and 63% compared with 46% and 36%, all respectively, for patients transplanted with relapsed/refractory disease. The hazard of mortality among patients transplanted with relapsed or refractory disease was 6.1 times that of patients transplanted in first CR or PR (p=0.0006).

Geisler et al. reported on 160 previously untreated patients with MCL with dose-intensified induction immunochemotherapy. (41) Responders received high-dose chemotherapy with in vivo purged autologous HSCT. Overall and CR was achieved in 96% and 54%, respectively. The 6-year OS, EFS, and PFS were 70%, 56%, and 66%, respectively, with no relapses occurring after 5 years.

Evens et al. reported on 25 untreated patients with MCL who received induction chemotherapy, with an overall response rate of 74%. (42) Seventeen patients received a consolidative autologous (n=13) or allogeneic (n=4) HSCT. Five-year EFS and OS for all patients was 35% and 50%, respectively. After a median follow-up of 66 months, the 5-year EFS and OS for patients who received autologous HSCT was 54% and 75%, respectively.

There have been several studies regarding reduced-intensity chemotherapy (RIC) and allogeneic HSCT. (43) Khouri et al. reported on results of RIC allogeneic HSCT in 18 patients with relapsed MCL, and after a median follow-up of 26 months, the actuarial probability of EFS was 82% at 3 years. (44) Maris et al. evaluated allogeneic HSCT in 33 patients with relapsed and recurrent MCL. At 2 years, the relapse and non-relapse mortality rates were 9% and 24%, respectively, and the OS and DFS were 65% and 60%, respectively. (45)

Tam and colleagues reported a retrospective study which included all patients with MCL who had undergone HSCT in sequential phase 2 protocols (autologous or nonmyeloablative allogeneic) at the University of Texas M.D. Anderson Cancer Center between February 1990 and June 2007. (46) The approach to transplantation was risk-adapted and based primarily on the patient's treatment status. Autologous HSCT was performed as consolidation therapy for patients in first remission after chemotherapy (1990-2001). From 2001 onward, because of the favorable clinical outcomes found with rituximab (R)-hyperCVAD chemotherapy, autologous HSCT was performed only in patients not in CR after R-hyperCVAD and in patients who had received less-intensive induction chemotherapy (e.g., CHOP-R). For patients with relapsed or primary refractory MCL, autologous HSCT was performed before the use of nonmyeloablative allogeneic in 1997. After 1997, nonmyeloablative allogeneic was performed whenever a histocompatible donor was available. Patients generally underwent autologous HSCT up to the age of 70 and RIC-allogeneic up to the age of 65 years. Since 2004, patients up to the age of 75 years could receive an autologous transplant. The study included 121 patients with MCL: 50 who underwent autologous HSCT in first CR (46%) or PR (54%) (AUTO1), 36 who

underwent autologous HSCT for relapsed or refractory disease (AUTO2), and 35 who underwent nonmyeloablative allogeneic for relapsed or refractory disease (NST). The ages at transplantation were similar in all 3 groups (median, 57 years [range: 38–73 years] for AUTO1; median, 59 years [range: 42–76 years] for AUTO2; and median, 58 years [range: 43–68 years] for NST).

For the AUTO1 group, at a median follow-up of 6 years, the actuarial PFS and OS were 39% and 61%, respectively, with median PFS and OS durations of 42 months and 93 months. Of the AUTO2 patients, 31% did not experience a response to initial chemotherapy but did experience a PR or better to salvage therapy with hyperCVAD (n=6), R-hyperCVAD (n=4), or methotrexate and ara-C (n=1). Seventeen patients (47%) were in their second remission, 3 (8%) were in their third or subsequent remission, and 5 (14%) had chemorefractory relapse and were transplanted in less than partial remission. The actuarial 6-year PFS and OS rates were 10% and 35%, respectively (p=0.01 and 0.02 compared with AUTO1), and the median PFS and OS durations were 27 and 52 months, respectively. These inferior results for both PFS and OS compared with AUTO1 patients were maintained in a multivariate analysis that accounted for differences in baseline factors.

Of the patients who underwent nonmyeloablative allogeneic HSCT for relapsed or refractory MCL, 20% did not experience a response to initial chemotherapy but experienced a PR or better to salvage therapy with R-hyperCVAD. Thirty-one percent were in their second remission, 31% were in their third or subsequent remission, and 17% had refractory relapse and received a transplant in less than partial remission. With a median follow-up of 56 months (range, 19-110 months), the median PFS duration was 60 months, and the median OS had not yet been reached. The 6-year actuarial PFS rate was 46%, and the 6-year actuarial OS rate was 53%. Plateaus in the survival curves were observed for both PFS and OS, with no relapses or deaths occurring in 9 patients followed between 63 and 110 months. These outcomes were significantly superior to that of AUTO2 patients, whereby relapses and deaths occurred in a continuous fashion (p=0.01 for PFS; p=0.005 for OS [4-year landmark for OS]). Compared with AUTO1 patients, the RIC-allogeneic HSCT patients had an initially lower OS; however, this reversed at 8 years because of the lack of late deaths among nonmyeloablative allogeneic patients.

The authors concluded that their study provides early evidence that MCL may be curable in both the frontline and salvage settings. In chemotherapy-naïve patients, their results showed that rituximab-containing autologous HSCT in first remission may result in long-term disease control, with only 1 relapse occurring among 11 patients followed between 2 and 8 years, in contrast to that of autologous transplantation without rituximab, in which relapses occurred in a continuous fashion. In contrast to frontline transplantation, the outcomes of autologous transplantation in patients with relapsed or refractory MCL remain unsatisfactory, with no evidence of a cured fraction on survival curves. The results of autologous and nonmyeloablative allogeneic HSCT in patients with relapsed or refractory MCL were also markedly different. Patients receiving a nonmyeloablative allogeneic transplant showed significantly superior disease control and a disease-free plateau, extending between 5 and 9 years, whereas patients who received an autologous transplant had a median remission of 2 years and experienced a continuous pattern of relapse. Therefore, nonmyeloablative allogeneic HSCT may be capable of salvaging a cure in patients no longer curable with maximum cytotoxic strategies.

The authors also summarize the two recent major therapeutic advances that have substantially altered the outlook of patients with MCL: 1) the introduction of rituximab, which in combination with chemotherapy, has improved the results of both frontline and salvage treatments for MCL, and 2) the combination of rituximab and hyperCVAD, which is capable of achieving CR rates of up to 90% in the frontline setting, with a prolonged 5-year failure-free survival of 60% in younger patients.

As noted in the Tam et al. study, (46) recent review articles on high-dose therapy for MCL reiterate the finding in several studies of a superior result of transplantation in first CR (autologous or allogeneic) rather than in the relapsed setting, and that intensive immunochemotherapy as induction therapy preceding high-dose therapy plus autologous HSCT is indicated. (10,47) Also noted are the results of the use of reduced-intensity allogeneic HSCT in the relapsed setting, showing survival plateaus and suggesting curative potential, and suggesting benefit in the use of this approach in younger, fit patients with relapsed MCL. (47)

Summary

Due in part to the relative rarity of the disease, randomized studies on the use of HSCT in MCL have not been conducted. Case series have shown long-term disease control of this aggressive lymphoma with the use of autologous HSCT (with rituximab) to consolidate a first remission; however, the use of autologous HSCT in the relapsed setting has not shown improved outcomes. Allogeneic HSCT has shown prolonged disease control in the relapsed/refractory setting.

Peripheral T-Cell Lymphoma (Mature T-cell or NK-cell neoplasms)

Frontline autologous HSCT

Prospective studies with autologous HSCT in patients with aggressive PTCL consist of only a few studies with small numbers of patients.

Reimer and colleagues conducted the largest prospective study of 83 patients with PTCL from multiple centers to undergo autologous HSCT as first-line therapy. (48) Patients had various histologies, including PTCL-NOS (not otherwise specified) (n=32), angioimmunoblastic (n=27), anaplastic lymphoma kinase-anaplastic large-cell lymphomas (ALK– ALCL) (n=13), and the remainder extranodal subtypes. Sixty-six percent of the patients received the transplant, with the main reason for not receiving the transplant being progression of disease. Of the patients who proceeded to transplant, 32 were in CR and 33 in PR. Treatment-related mortality (TRM) was 3.6%. Median follow-up was 33 months, and the estimated 3-year OS and PFS rates were 48% and 36%, respectively.

Corradini and colleagues reported the results of two Phase II studies involving 62 patients with advanced stage PTCL at diagnosis. (49) In an intention-to-treat (ITT) analysis, 46 of the 62 (74%) completed the whole program. The 16 patients failed to undergo transplant due to early disease progression and/or toxicity. Pretransplant, 56% of patients were in CR, and 16% in PR. Median follow-up was 76 months, with an estimated 12-year OS, DFS, and EFS of 34%, 55%, and 30%, respectively. Five-year EFS and OS were 40 and 50%, respectively. A multivariate analysis showed that patients who achieved CR before HSCT had a statistically significant benefit in OS and EFS (p=0.0001).

Mercadal and colleagues reported results of a Phase II trial involving 41 patients consecutively diagnosed with PTCL (median age: 47 years). Patients who responded to induction

chemotherapy (CR or PR) went on to autologous HSCT. (50) Twenty-four patients responded (CR n=20 and PR n=4). Seventeen of these 24 underwent HSCT (the remaining patients did not due to various reasons including lack of stem-cell mobilization, toxicity, and early relapse). For patients who completed the entire procedure, CR was 51% and PR 7%. Median follow-up was 3.2 years (range: 0.6–8.1), and 5 of 21 CR patients relapsed and 2 died in CR due to a secondary malignancy. Four-year PFS was 30% (95% confidence interval [CI]: 15–45%), and OS was 39% (95% CI: 22–56%). No difference in OS was noted among the 24 patients who were eligible for transplant, 17 of whom underwent transplant and 7 who did not.

A prospective Phase II trial by Rodriguez et al. showed that autologous HSCT as first-line consolidation therapy improved treatment outcome in patients responding to induction therapy. (51) Nineteen of 26 patients who showed CR or PR to induction therapy received an autologous HSCT. At 2 years' post-transplant, OS, PFS, and DFS were 84%, 56%, and 63%, respectively.

Salvage (relapsed or refractory) autologous HSCT
Kewalramani and colleagues retrospectively compared a review of 24 consecutive patients with PTCL who underwent autologous HSCT for relapsed or refractory disease after responding to second-line therapy and compared the results with those of 86 consecutive patients with chemosensitive relapsed or primary refractory DLBCL. (52) Patients with less aggressive histologies (e.g., ALCL expressing the ALK protein) were excluded. Median follow-up time was 6 years, and the 5-year PFS rates for PTCL and DLBCL were 24% and 34%, respectively (p=0.14). OS rates were 33% and 39%, respectively. Disease progression occurred in 83% of patients with PTCL and 65% of patients with DLBCL (p=0.13). In a univariate analysis of survival for patients with PTCL, response to second-line therapy and the second-line age-adjusted international prognostic index (sAAIPI) were prognostic for both PFS and OS. The authors noted that the outcomes for PTCL and DLBCL patients were similar when stratified by the sAAIPI, in contrast to patients undergoing first-line chemotherapy, where T-cell histology consistently confers a poorer prognosis across IPI subgroups.

Song and colleagues compared the outcomes of 36 patients with PTCL who underwent autologous HSCT with 97 patients with relapsed DLBCL. (53) Of the patients with PTCL, 27 were at first relapse, 2 at greater than 1 relapse and 7 had primary refractory disease. Twenty patients had PTCL-unspecified (PTCL-u), 9 had ALCL, and the remainder a mixture of rarer subtypes. Baseline patient characteristics were similar between the PTCL and DLBCL groups. Three-year OS and EFS were 48% and 37%, respectively for PTCL and 53% and 42 % for DLBCL (p=0.41 and 0.29, respectively). The patients with PTCL-u had an inferior EFS when compared to the DLBCL patients (23%, p=0.028), and those with ALCL had a nonsignificant trend for improved EFS (67%, p=0.41).

Rodriguez and colleagues reported the largest series of patients with refractory or relapsed PTCL who received an autologous HSCT. (54) One-hundred twenty-three patients were derived from registry data between 1990 and 2004. Response to transplantation was as follows: in patients in whom response could be assessed (119 of 123), 73% achieved a CR, 11% a PR, and transplant failed to produce benefit in 16% of patients who had stable or progressive disease. Median follow-up was 61 months (range: 0–182). Five-year PFS was 34% (95% CI: 25–44%) and 5-year OS was 45% (95% CI: 36–55%). DFS at 5 years for complete responders was 47% (95% CI: 35–58%).

Allogeneic HSCT
A recent review article on the impact of HSCT in peripheral T-cell lymphomas states that no relevant data for the use of allogeneic HSCT in the front-line setting are available. (52) To further investigate the role of HSCT in previously untreated PTCL, the DSHNHL (German High-grade NHL Study Group) will initiate a prospective randomized multicenter trial comparing upfront autologous versus allogeneic HSCT following induction chemotherapy. (55)

For relapsing and refractory PTCL, data on the use of allogeneic HSCT consist of case reports and approximately 5 retrospective series with at least 10 patients. (55)

Jacobsen and colleagues reported a single-center experience over 12 years using allogeneic HSCT in 52 patients with PTCL or advanced mycosis fungoides/Sezary syndrome. (56) Patients had a variety of disease subtypes, including nodal and extranodal histologies. Eleven patients had undergone a prior autologous HSCT. At the time of the allogeneic HSCT, 23 patients (44%) were in first or subsequent CR and 16 (31%) had a PR. Thirty-one (60%) patients underwent myeloablative conditioning and 21 (40%) underwent RIC. The median follow-up was 49 months. Three-year PFS was 30% (45% in patients with nodal histologies and 6% in patients with extranodal histologies). Overall survival at 3 years was 41% for all patients. The authors concluded that allogeneic HSCT can produce long-term remissions in relapsed/refractory T-cell lymphoma and that plateaus in both OS and PFS curves suggest that allogeneic HSCT may be curative in a select group of patients.

Kyriakou and colleagues reported the outcomes of 45 patients with angioimmunoblastic lymphoma who were in the European Group for Blood and Marrow Transplantation database and had undergone an allogeneic HSCT between 1998 and 2005. (57) Eleven patients had failed a prior autologous transplant. Twenty-five patients underwent myeloablative and 20 reduced-intensity conditioning (RIC). Non-relapse mortality was 18%, 22%, and 25% at 3, 6, and 12 months, respectively. The median follow-up time for the surviving patients was 29 months (range 6-76 months). The estimated OS rate at 1 and 3 years was 66% and 64%, respectively. OS for chemotherapy-sensitive patients was significantly better at 81% at 3 years. (For survival comparison, the authors state that angioimmunoblastic lymphoma is characterized by an aggressive clinical course and carries a poor prognosis and that with chemotherapy, OS is less than 30% at 5 years).

Corradini and colleagues reported outcomes of 17 patients with relapsed or refractory PTCL who underwent a reduced intensity allogeneic HSCT. (58) Median age of the patients was 41 years (range: 23-60 years). Two of the patients had primary chemorefractory disease, 15 had relapsed disease, and 8 had disease relapse after a prior autologous HSCT. After a median follow-up of 28 months from the day of study entry (range: 3-57 months), 14 patients were alive. PFS and OS at 3 years were 64% (95% CI: 39–89%) and 81% (95% CI: 62–100%), respectively. In this initial series, 15 of the 17 patients had chemotherapy-sensitive disease before transplant. In an update of their experience in 35 patients with a median follow-up of 44 months, PFS and OS were 49% and 54%, respectively.

Le Gouill and colleagues retrospectively reported a large series of patients with several different aggressive histologic subtypes of peripheral T-cell lymphoma who underwent allogeneic HSCT. (59) Seventy-seven patients from 20 French centers who underwent transplant between 1988 and 2006 were included. Median age at diagnosis was 36 years (range: 12–61 years). Median follow-up was 43 months (range: 3.5 to 195 months). Fifty-seven

patients received a myeloablative conditioning regimen. All of the patients had received at least one line of therapy before the allogeneic HSCT, including an autologous HSCT in 25% of cases. Five-year toxicity-related mortality incidence was 33% (95% CI: 24–46%). Overall 5-year OS and EFS rates were 57% (95% CI: 45–68%) and 53% (95% CI: 41–64%), respectively. There was a large variation in OS and EFS rates by the histopathologic subtypes: 5-year OS and EFS rates were 80% (95% CI: 39–94%) and 80% (95% CI: 39–94%) for patients with angioimmunoblastic T-cell lymphoma, 63% (95% CI: 41 to 79%) and 58% (95% CI: 35–75%) for PTCL-NOS, and 55% (95% CI: 35–72%), and 48% (95% CI: 28–65%) for ALCL patients, respectively. The 5-year OS for other histopathologic subtypes (n=12) was 33% (95% CI: 8–58%), and 4 of these patients were still alive in CR. All of the patients who could not achieve CR after allogeneic HSCT died within 10 months as a result of disease progression. In a multivariate analysis, the strongest predictors of OS were chemotherapy-resistant disease at the time of the allogeneic transplant and the occurrence of severe (grade 3 or 4) acute graft-versus-host disease (GVHD).

Summary
The role of HSCT in peripheral T-cell lymphoma (PTCL) is not well-defined. Few studies have been conducted, many of these retrospectively, with small numbers of patients and heterogeneous patient populations including good- and poor-risk patients in the same study. This is partly due to the rarity and heterogeneity of this group of lymphomas. In particular, studies often mix patients with PTCL-NOS (which has a poorer prognosis) with patients with ALK + ALCL which has a better prognosis (even with conventional chemotherapy regimens), and ALK- ALCL patients who have a worse prognosis than ALK+ ALCL but better than PTCL-NOS patients.

There have been no randomized studies comparing chemotherapy regimens solely in patients with peripheral T-cell lymphoma (i.e., some randomized studies have included peripheral T-cell lymphoma with aggressive B-cell lymphomas).

Reviews summarize the most recent and largest studies on the use of HSCT as frontline and salvage therapy for PTCL. (60, 61) For frontline therapy, results from recent Phase II studies with autologous HSCT as consolidation offers the best survival outcomes for patients with high-risk features; randomized trials to confirm this have not been performed. No relevant data for the use of allogeneic HSCT in the front-line setting are available.

Approximately 30–60% of these patients do not reach transplantation due to early disease progression or toxicity, and 20–30% relapse after transplantation. Patients with relapsed or refractory disease are generally considered incurable with chemotherapy alone. In the salvage setting, the data show that the use of HSCT may improve survival outcomes similar to the results seen in corresponding aggressive B-cell lymphomas in the same treatment setting.

National Cancer Institute PDQ Database
A search of the National Cancer Institute’s Physician Data Query database identified no Phase III trials directly addressing the use of HSCT specifically for mantle cell or T-cell lymphoma.

National Comprehensive Cancer Network (NCCN) guidelines (62)
<u>Follicular lymphoma/Indolent lymphomas</u>
- Autologous HSCT as consolidative therapy for patients in second or third remission (category 2A)

- Allogeneic (fully myeloablative or nonmyeloablative) in highly selected patients

Diffuse large B-cell lymphoma

- Autologous HSCT as first-line consolidation in high-risk patients. (category 2B)
- Autologous HSCT for relapsed or refractory disease. (category 2A)

Mantle cell lymphoma

- Autologous HSCT as consolidative therapy in first remission. (category 2A)
- Autologous HSCT for patients with relapsed disease following CR to induction therapy, those patients who obtain only a PR to induction therapy, or those with progressive disease. (category 2A)
- Allogeneic (fully myeloablative or nonmyeloablative) for second-line consolidation. (category 2A)

Peripheral T-cell lymphoma

- Autologous HSCT as first-line consolidation therapy in patients showing a good response to induction therapy (except those considered low-risk, e.g., ALCL ALK-positive). (category 2A)
- Autologous or allogeneic (fully myeloablative or nonmyeloablative) HSCT as second-line consolidation in patients with relapsed or refractory disease with PR or CR to second-line therapy. (category 2A)

Cutaneous T-cell lymphoma (Mycosis Fungoides/Sezary Syndrome)

- For relapsed, refractory, or progressive disease, consider allogeneic HSCT. (category 2A)

Adult T-cell leukemia/lymphoma

- After CR or for persistent or progressive disease, consider allogeneic HSCT. (category 2A)

Clinical input Received through Physician Specialty Society and Academic Medical Center

In response to requests, Blue Cross Blue Shield Association received input from 1 physician specialty society and 1 academic medical center while this policy was under review for March 2009. While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted. There was general agreement with the policy statements. Both reviewers agreed that RIC allogeneic HSCT should be considered medically necessary in patients with non-Hodgkin lymphoma (NHL) who do not qualify for a myeloablative allogeneic HSCT. One reviewer responded on the medical necessity of HSCT in patients with MCL in first remission and recently published literature supports this. There was conflicting input on whether HSCT should be considered investigational for peripheral T-cell lymphoma. Also, one reviewer commented that with the increasing use of rituximab and its success in improving patient outcomes, the role of HSCT in consolidating first CR in high-risk patients is coming into question.

In response to requests, input was received from 3 physician specialty societies and 3 academic medical centers while this policy was under review for February 2011. While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted. Reviewer input was solicited particularly for the use of HSCT in MCL and PTCL. There was uniform agreement for the use of autologous HSCT to consolidate a first remission in MCL. There was general

agreement for the use of allogeneic HSCT as salvage therapy for MCL, with less agreement on the use of autologous HSCT in the salvage setting. For PTCL, there was general agreement on the use of autologous HSCT to consolidate a CR in high-risk patients and in the salvage setting. Input was split on the use of allogeneic HSCT to consolidate a first CR or as salvage therapy, but there was more support to consider it medically necessary in both settings.

Government Regulations

National:

National Coverage Determination (NCD) for Stem Cell Transplantation (110.8.1), Effective Date of this Version 8/4/10, Implementation Date 11/10/10, Retrieved from: http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=45&ncdver=5&bc=AgAAgAAAAAAA&, Accessed 7/31/12.

Indications and Limitations of Coverage

1. **Allogeneic Hematopoietic Stem Cell Transplantation (HSCT)**
   Allogeneic hematopoietic stem cell transplantation (HSCT) is a procedure in which a portion of a healthy donor's stem cell or bone marrow is obtained and prepared for intravenous infusion.
   a. Nationally Covered Indications
      The following uses of allogeneic HSCT are covered under Medicare:
      i. Effective for services performed on or after August 1, 1978, for the treatment of leukemia, leukemia in remission, or aplastic anemia when it is reasonable and necessary,
      ii. Effective for services performed on or after June 3, 1985, for the treatment of severe combined immunodeficiency disease (SCID) and for the treatment of Wiskott-Aldrich syndrome.
      iii. Effective for services performed on or after August 4, 2010, for the treatment of Myelodysplastic Syndromes (MDS) pursuant to Coverage with Evidence Development (CED) in the context of a Medicare-approved, prospective clinical study.

2. **Autologous Stem Cell Transplantation (AuSCT)**
   Autologous stem cell transplantation (AuSCT) is a technique for restoring stem cells using the patient's own previously stored cells.
   a. Nationally Covered Indications
      i. Effective for services performed on or after April 28, 1989, AuSCT is considered reasonable and necessary under §l862(a)(1)(A) of the Social Security Act (the Act) for the following conditions and is covered under Medicare for patients with:
         - Acute leukemia in remission who have a high probability of relapse and who have no human leucocyte antigens (HLA)-matched;
         - Resistant non-Hodgkin's lymphomas or those presenting with poor prognostic features following an initial response;
         - Recurrent or refractory neuroblastoma; or
         - Advanced Hodgkin's disease who have failed conventional therapy and have no HLA-matched donor.
      ii. Effective October 1, 2000, single AuSCT is only covered for Durie-Salmon Stage II or III patients that fit the following requirements:

- Newly diagnosed or responsive multiple myeloma. This includes those patients with previously untreated disease, those with at least a partial response to prior chemotherapy (defined as a 50% decrease either in measurable paraprotein [serum and/or urine] or in bone marrow infiltration, sustained for at least 1 month), and those in responsive relapse; and,
- Adequate cardiac, renal, pulmonary, and hepatic function.

iii. Effective for services performed on or after March 15, 2005, when recognized clinical risk factors are employed to select patients for transplantation, high dose melphalan (HDM) together with AuSCT is reasonable and necessary for Medicare beneficiaries of any age group with primary amyloid light chain (AL) amyloidosis who meet the following criteria:
- Amyloid deposition in 2 or fewer organs; and,
- Cardiac left ventricular ejection fraction (EF) greater than 45%.

b. Nationally Non-Covered Indications

Insufficient data exist to establish definite conclusions regarding the efficacy of AuSCT for the following conditions:

- Acute leukemia not in remission;
- Chronic granulocytic leukemia;
- Solid tumors (other than neuroblastoma);
- Up to October 1, 2000, multiple myeloma;
- Tandem transplantation (multiple rounds of AuSCT) for patients with multiple myeloma;
- Effective October 1, 2000, non primary AL amyloidosis; and,
- Effective October 1, 2000, thru March 14, 2005, primary AL amyloidosis for Medicare beneficiaries age 64 or older.

In these cases, AuSCT is not considered reasonable and necessary within the meaning of §l862(a)(1)(A) of the Act and is not covered under Medicare.

B. Other

All other indications for stem cell transplantation not otherwise noted above as covered or non-covered nationally remain at local contractor discretion.

Local:

There is no local coverage determination on this topic.

Michigan Department of Community Health:

Medicaid Provider Manual, Version Date: April 1, 2012, Retrieved from http://www.mdch.state.mi.us/dch-medicaid/manuals/MedicaidProviderManual.pdf, Accessed: 7/31/12.

6.6 Transplants

Heart, bone marrow, liver, lung, simultaneous pancreas/kidney and pancreas transplants are reimbursed at the hospital's Medicaid cost to charge ratio.

- Organ acquisition costs are reimbursed at 100% of charges when billed using either revenue code 0811 or 0812. This applies to heart, kidney, liver, lung, simultaneous pancreas/kidney, or pancreas transplants. **This does not apply to bone marrow transplants. All bone marrow transplant charges are reimbursed at the hospital's cost to charge ratio.**
- The letter of authorization for the transplant from the Office of Medical Affairs (OMA) or MHP must be attached to all transplant claims, otherwise, payment is denied.

- Indicate "PA letter submitted" in the Remarks Section of the submitted claim.
- For other transplant services not described by a specific DRG, identify in the Remarks Section the type of transplant that has been performed (i.e., small bowel transplant).
- If the donor and beneficiary are both Medicaid eligible, the services must be billed under each beneficiary's respective ID Number. If only the beneficiary is Medicaid eligible, bill services for both donor and beneficiary under the Medicaid beneficiary's ID Number.

All other insurance resources must be exhausted before Medicaid is billed. If Medicare eligibility is denied, the denial notice must be submitted with the claim.

(The above Medicare information is current as of the review date for this policy. However, the coverage issues and policies maintained by the Centers for Medicare & Medicare Services [CMS, formerly HCFA] are updated and/or revised periodically. Therefore, the most current CMS information may not be contained in this document. For the most current information, the reader should contact an official Medicare source.)

Related Policies

- BMT – Autologous, for Malignant Astrocytomas and Gliomas
- BMT – Hematopoietic Stem Cell Transplantation for Breast Cancer
- BMT – Hematopoietic Stem Cell Transplantation for Treatment of Multiple Myeloma
- BMT – Hematopoietic Stem Cell Transplantation for Acute Lymphoblastic Leukemia
- BMT – Hematopoietic Stem Cell Transplantation for Acute Myeloid Leukemia
- BMT – Hematopoietic Stem Cell Transplantation for Autoimmune Diseases
- BMT – Hematopoietic Stem Cell Transplantation for Chronic Lymphocytic Leukemia and Small Lymphocytic Lymphoma - Autologous or Allogeneic
- BMT – Hematopoietic Stem Cell Transplantation for Chronic Myelogenous Leukemia
- BMT – Hematopoietic Stem Cell Transplantation for CNS Embryonal Tumors and Ependymoma
- BMT – Hematopoietic Stem Cell Transplantation for Epithelial Ovarian Cancer
- BMT – Hematopoietic Stem Cell Transplantation for Hodgkin Lymphoma
- BMT – Hematopoietic Stem Cell Transplantation for Miscellaneous Solid Tumors in Adults
- BMT – Hematopoietic Stem Cell Transplantation for Primary Amyloidosis
- BMT – Hematopoietic Stem Cell Transplantation for Solid Tumors of Childhood
- BMT – Hematopoietic Stem Cell Transplantation for Waldenström's Macroglobulinemia
- BMT – Hematopoietic Stem Cell Transplantation in the Treatment of Germ-Cell Tumors
- Donor Lymphocyte Infusion for Malignancies Treated with an Allogeneic Hematopoietic Stem-Cell Transplant

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The articles reviewed in this research include those obtained in an Internet based literature search for relevant medical references through August 1, 2013, the date the research was completed.

Joint BCBSM/BCN Medical Policy History

Policy Effective Date	BCBSM Signature Date	BCN Signature Date	Comments
1/1/13	10/16/12	10/16/12	• Topic split out from former combined bone marrow transplant policies. • Policy formatted to mirror BCBSA. • Added “relative contraindications” to inclusionary/exclusionary section. • Removed deleted codes G0265, G0266 and G0267.

Next Review Date: 4th Qtr, 2013

BLUE CARE NETWORK BENEFIT COVERAGE
POLICY: BMT - HEMATOPOIETIC STEM-CELL TRANSPLANTATION FOR NON-HODGKIN LYMPHOMAS

I. Coverage Determination:

Commercial HMO (includes Self-Funded groups unless otherwise specified)	Covered; criteria apply
BCNA (Medicare Advantage)	Refer to Medicare section.
BCN65 (Medicare Complementary)	Coinsurance covered if primary Medicare covers the service.
Blue Cross Complete of Michigan	Refer to Medicare section.

II. Administrative Guidelines:

- The member's contract must be active at the time the service is rendered.
- The service must be authorized by the member's PCP except for Self-Referral Option (SRO) members seeking Tier 2 coverage.
- Services must be performed by a BCN-contracted provider, if available, except for Self-Referral Option (SRO) members seeking Tier 2 coverage.
- Payment is based on BCN payment rules, individual certificate and certificate riders.
- Appropriate copayments will apply. Refer to certificate and applicable riders for detailed information.
- CPT - HCPCS codes are used for descriptive purposes only and are not a guarantee of coverage.