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Medical Policy Manual

Topic: Hematopoietic Stem-Cell Transplantation for Non-Hodgkin Lymphomas

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IMPORTANT REMINDER

Medical Policies are developed to provide guidance for members and providers regarding coverage in accordance with contract terms. Benefit determinations are based in all cases on the applicable contract language. To the extent there may be any conflict between the Medical Policy and contract language, the contract language takes precedence.

PLEASE NOTE: Contracts exclude from coverage, among other things, services or procedures that are considered investigational or cosmetic. Providers may bill members for services or procedures that are considered investigational or cosmetic. Providers are encouraged to inform members before rendering such services that the members are likely to be financially responsible for the cost of these services.

DESCRIPTION

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 gene 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 (myeloablative chemotherapy). 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 (i.e., therapy that is intended to eliminate residual cancer cells after initial 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 myelotoxic agents (e.g., cyclophosphamide, busulfan) with or without total body irradiation at doses sufficient to cause bone marrow failure. The beneficial treatment effect in this procedure is due to a combination of initial eradication of malignant cells and the subsequent graft-versus-malignancy (GVM) effect that develops 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. While such treatment may eliminate the malignant cells, patients are as likely to die from opportunistic infections, graft-versus-host disease (GVHD), and/or organ failure as from the underlying malignancy.

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 adverse effects secondary to bone marrow toxicity, while retaining the beneficial graft-versus-malignancy effect of allogeneic transplantation. These regimens do not initially eradicate the patient's hematopoietic ability, allowing relatively prompt hematopoietic recovery (e.g., 28 days or less) even without a transplant. Patients who undergo RIC with allogeneic SCT 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. A number of different cytotoxic regimens, with or without radiotherapy, may be used for RIC allotransplantation. They represent a continuum in their effects, from nearly totally myeloablation, to minimal myeloablation with lymphoablation.

Although the definition of RIC remains arbitrary, with numerous versions employed, all seek to balance the competing effects of nonrelapse mortality (NRM) and relapse due to residual disease. For the purposes of this Policy, the term "reduced-intensity conditioning" will refer to all conditioning regimens intended to be non-myeloablative, as opposed to fully myeloablative (traditional) regimens.

Tandem HSCT

Tandem transplants usually are defined as the planned administration of two 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.

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

Within the B-cell and T-cell categories, two subdivisions are recognized: precursor neoplasms, which correspond to the earliest stages of differentiation, and more mature differentiated neoplasms.

2008 WHO Classification[4]

In the lists below, the asterisk (*) represents provisional entities or provisional subtypes of other neoplasms. Diseases shown in italics are newly included in the 2008 WHO classification.

The Mature B-Cell Neoplasms

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

- Waldenström 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$^+$ 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

<u>The Mature T-Cell and NK-Cell Neoplasms</u>

T-cell prolymphocytic leukemia

T-cell large granular lymphocytic leukemia

Chronic lymphoproliferative disorder of NK-cells*

Aggressive NK cell leukemia

Systemic EBV$^+$ 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^-

In the United States, 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]

Several subtypes of NHL have emerged with the REAL/WHO classification with unique clinical and biologic features, and they will be addressed separately throughout the policy, when necessary (specifically MCL and PTCL).

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. Follicular lymphoma (FL) 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.

Based on the number of risk factors present and adjusted for patient age, the IPI defines 4 risk groups: low, low intermediate, high intermediate, and high risk, based on 5 significant risk factors prognostic of overall survival (OS):

- Age older than 60 years
- Elevated serum lactate dehydrogenase (LDH) level
- Ann Arbor stage III or IV disease
- Eastern Cooperative Oncology Group (ECOG) performance status of 2, 3, or 4
- 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 two or more risk factors have a less than 50% chance of relapse-free (RFS) survival 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 five adverse prognostic factors:

- Age older than 60 years
- Ann Arbor stage III-IV
- Hemoglobin level less than 12.0 g/dL
- More than four lymph node areas involved
- Elevated serum lactate dehydrogenase (LDH) level

These five factors are used to stratify patients into three categories of risk: low (0-1 risk factor), intermediate (two risk factors), or poor (three 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.[10] 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 serious limitations, which included no separation of some important risk groups.[11] 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.[11] 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):

- Age
- ECOG performance status
- Serum LDH (calculated as a ratio of LDH to a laboratory's upper limit of normal)
- 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 three groups with significantly different prognoses:[11]

- 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)

Immature T-cell lymphomas are generally treated on leukemia protocols, whereas mature (peripheral) T-cell lymphomas are usually treated with chemotherapy regimens similar to those used in DLBCL.

PTCLs are less responsive to standard chemotherapy than DLBCLs and therefore carry a worse prognosis than aggressive B-cell counterparts. The poor results with conventional chemotherapy have prompted exploration of the role of HDC/SCT as first-line consolidation 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 two 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.

MEDICAL POLICY CRITERIA

Note: Hematopoietic stem-cell transplantation (HSCT) in the treatment of Hodgkin lymphoma is addressed in medical policy Transplant No. 45.30.

HSCT in the treatment of chronic lymphocytic leukemia and small lymphocytic lymphoma are considered separately in medical policy Transplant No. 45.35

HSCT in the treatment of Waldenstrom macroglobulinemia, a lymphoplasmacytic lymphoma, is considered separately in medical policy Transplant No. 45.40

I. Autologous HSCT

   A. Medically necessary indications

      Autologous HSCT may be considered **medically necessary** for treatment of non-Hodgkin lymphomas (NHL) *except* as an initial treatment for NHL.

   B. Investigational indications

      Autologous HSCT is considered **investigational** as initial therapy (i.e., without a full course of standard-dose induction chemotherapy) for NHL.

II. Allogeneic HSCT

   A. Medically necessary indications

Myeloablative allogeneic HSCT may be considered **medically necessary** for treatment of NHL *except* as an initial treatment.

B. Investigational indications

Myeloablative allogeneic HSCT is considered **investigational** as initial therapy (i.e., without a full course of standard-dose induction chemotherapy) for NHL.

C. Reduced intensity conditioning (RIC) allogeneic HSCT

RIC allogeneic HSCT may be considered **medically necessary** for treatment of NHL when BOTH of the following criteria (A and B) are met (see further discussion in the Policy Guidelines):

1. All of the medical necessity criteria for myeloablative allogeneic HSCT are met; and

2. The patient does not qualify for a myeloablative allogeneic HSCT (see Policy Guidelines).

III. Tandem HSCT

Tandem HSCT (e.g., autologous - autologous, autologous – allogeneic) is considered **investigational** to treat patients with any stage, grade, or subtype of NHL.

Policy Guidelines

Reduced-intensity conditioning (RIC) would be considered an option in patients who meet criteria for an allogeneic stem-cell transplant (SCT) 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.

SCIENTIFIC BACKGROUND

The principal outcomes associated with treatment of non-Hodgkin lymphomas (NHL) are typically measured in units of survival past treatment: disease-free survival (DFS), a period of time following treatment where the disease is undetectable; progression-free survival (PFS), the duration of time after treatment before the advancement or progression of disease; and overall survival (OS), the period of time the patient remains alive following treatment. Risk of graft-versus-host disease is another primary outcome among patients undergoing allogeneic hematopoietic stem cell transplantation (HSCT). Ideally, in order to understand the impact of HSCT for treatment of NHL, comparative clinical trials that compare this therapy with standard medical treatment, such as standard chemotherapy regimens, are needed. Further, for treatment of any of these lymphomas, particularly those with a poor prognosis, an

understanding of any adverse treatment effects must be carefully weighed against any benefits associated with treatment to understand the net treatment effect.

This policy was initially based on four 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 2012, Al Khabori et al. performed a systematic review and meta-analysis of the use of autologous HSCT in untreated, advanced follicular lymphoma.[16] Four randomized controlled trials (RCTs) comparing autologous HSCT to conventional chemotherapy in 941 patients was included. Three trials reported overall survival (OS); moderate quality evidence from these trials did not show an improved OS with the use of HSCT as part of the initial treatment of FL. Adverse outcomes including treatment-related mortality and the development of myelodysplastic syndrome, acute myeloid leukemia, and solid tumors, were not different between the two arms.

- Schaaf and colleagues conducted a systematic review and meta-analysis on the use of HSCT for as treatment of follicular lymphoma (FL) for the Cochrane databases, published in 2012.[17] The researchers identified four trials focusing on HSCT as first-line treatment for FL, the results of which are discussed individually below.[18-21] The primary outcome of the analysis was overall survival, and secondary outcomes included progression-free survival, treatment-related mortality, and secondary malignancies. After pooling results from the below trials, the authors concluded that there is no evidence to support the use of HSCT for improved overall survival in first-line treatment of FL. Although improvements in treatment-related mortality and secondary malignancies were similarly not significantly associated with use of HSCT, transplantation was significantly associated with improved progression-free survival in FL.

- In a 2013 meta-analysis, Wang and others aimed to define the treatment effect of intensified therapy followed by autologous HSCT compared with conventional therapy as first-line treatment of patients with FL in terms of OS and event-free survival (EFS).[22] The authors identified 4 randomized controlled trials that included 941 subjects. Results of the study indicated that no additional survival benefit was derived from the intensified therapy followed by autologous HSCT. Authors did identify a significant benefit of intensified therapy followed by autologous HSCT as first-line treatment in terms of EFS. Authors concluded that intensified therapy followed by autologous HSCT does not improve the OS compared with conventional therapy.

- In 2008, Ladetto et al. reported the results of a Phase III, randomized, multicenter trial of patients with high-risk follicular lymphoma, treated at diagnosis.[18] A total of 134 patients were enrolled to receive either rituximab-supplemented high-dose chemotherapy (HDC) and autologous HSCT or six courses of cyclophosphamide, doxorubicin (or Adriamycin®), vincristine (Oncovin®), and prednisolone (CHOP) followed by rituximab (CHOP-R). Of these patients 79% completed R-HDC 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 on two or more consecutive bone marrow samples

spaced 6 months apart in patients who reached complete remission [CR]) 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.[19] 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 (HDC) 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, intent-to-treat analysis showed no difference between the two 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 follicular lymphoma, 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 follicular lymphoma 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.[20] 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 follicular lymphoma 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 follicular lymphoma, mantle cell lymphoma, or lymphoplasmacytoid lymphoma.[21] 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.

<u>HSCT for Relapsed, Indolent NHL</u>

In the majority of patients with follicular lymphoma relapse, and with relapsed disease, cure is very unlikely, with a median survival of 4.5 years after recurrence.[23] In the European CUP trial, 89 patients with relapsed, nontransformed follicular lymphoma with partial or complete response after standard induction chemotherapy were randomized to one of three arms: three additional cycles of conventional chemotherapy (n=24), HDC and unpurged autologous HSCT (n=33), or HDC with purged autologous HSCT (n=32). OS at four years for the chemotherapy versus unpurged versus purged arms was 46%, 71%, and 77%, respectively. Two-year PFS was 26%, 58%, and 55%, respectively. No difference was found between the two autologous HSCT arms. Although several studies have consistently shown improved disease-free survival (DFS) with autologous HSCT for relapsed follicular lymphoma, this study was the first to show a difference in OS benefit.[6]

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 of autologous HSCT 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.[24-27] As summarized in an editorial, the preponderance of evidence showed that consolidating first CRs with HSCT did not improve OS for the full population of enrolled patients.[28] 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 overall (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.[29]

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 at high- and high-intermediate risk of relapse. Nevertheless, many clinicians view the LNH87-2 subgroup analysis[30] as sufficient evidence to support use of autologous HSCT to consolidate a first CR when risk of relapse is high. In contrast, editorials[28,30] and recent reviews[31-33] 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 showed 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 HDC with autologous HSCT as first-line treatment in patients with aggressive NHL improves survival compared to patients treated with conventional chemotherapy.[34] 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 with 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 for autologous HSCT as first-line treatment in aggressive NHL.

- Betticher et al. reported the results of a Phase III multicenter, randomized trial comparing sequential HDC with autologous HSCT with standard CHOP as first-line therapy in 129 patients with aggressive NHL.[35] 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 HDC and autologous HSCT to conventional chemotherapy as frontline therapy in 56 patients with high-risk aggressive NHL.[36]

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 HDC with autologous HSCT versus conventional chemotherapy (plus autologous HSCT in cases of failure).[37] In the conventional group, 29 patients achieved a partial response or no response, and went on to receive HDC 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, respectively) between the two groups. The authors concluded that patients with aggressive NHL do not benefit from upfront autologous HSCT.

HSCT for Relapsed, Aggressive NHL

Autologous HSCT is the treatment of choice for relapsed or refractory aggressive NHL for patients who achieve a complete or partial response with second-line therapy. (1,4).[1,38]

Data from randomized trials have shown conflicting results, but some have shown an 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.[39] 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 HDC with autologous HSCT.[40] 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, non-randomized, prospective trial consisting of 112 patients with previously untreated diffuse large B-cell lymphoma and age-adjusted IPI score of 2-3.[41] All patients received rituximab-supplemented, early-intensified HDC 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.

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.

Allotransplant After a Failed Autotransplant

An updated literature search found no prospective randomized controlled studies comparing allotransplants to alternative strategies for managing failure (progression or relapse) after an autologous HSCT for NHL. The scant data are insufficient to change conclusions of the previous TEC Assessment.[14]

The paucity of outcomes data for allotransplants after a failed autologous HSCT is not surprising. Patients are rarely considered eligible for this option either because their relapsed lymphoma progresses too rapidly, because their advanced physiologic age or poor health status increases the likelihood of adverse outcomes (e.g., from graft-versus-host-disease), or because they lack a well-matched donor. Nevertheless, several institutions report that a minority of patients achieved long-term DFS following an allotransplant for relapsed NHL after an autotransplant. Factors that apparently increase the likelihood of survival include a chemosensitive relapse, younger age, a long disease-free interval since the prior autotransplant, availability of an HLA-identical sibling donor, and fewer chemotherapy regimens prior to the failed autotransplant. Thus, clinical judgment can play an important role to select patients for this treatment with a reasonable likelihood that potential benefits may exceed harms.

NHL Subtypes Newly Defined by the WHO Classification

<u>Mantle Cell Lymphoma (MCL)</u>

- In an attempt to improve the outcome of MCL, several Phase II trials investigated the efficacy of autologous HSCT, with published results differing substantially.[11,42] Some studies found no benefit to HSCT, and others suggested an EFS advantage, at least in a subset of patients.[11] The differing results in these studies were likely due to different time points of transplant (first vs. second remission) and other patient selection criteria.[42]

  In 2005, the results of the first randomized trial were reported by Dreyling and colleagues of the European MCL Network.[42] 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.

  Jantunen et al. investigated the feasibility and efficacy of autologous HSCT in patients with MCL older than 65 years. In the retrospective comparison, there were no differences in relapse rate, PFS,

or OS between patients with MCL under 65 years of age and the seventy-nine patients ≥65 years of age.[43]

- The literature regarding allogeneic transplantation in mantle cell lymphoma is limited. This is due, in part, to the fact that the average age of patients at diagnosis is 65 years, making them unsuitable for allogeneic transplant. Although a graft-versus-tumor effect has been demonstrated [44], there is currently no conclusive evidence that allogeneic transplantation is curative in mantle cell lymphoma.[45]

  In an International Bone Marrow Transplant Registry (IBMTR) study, 212 patients (median age 50 years) received allogeneic transplants.[46] At two years, OS was only 40%. In a study by the European Bone Marrow Transplant Group, 22 allogeneic transplant patients had EFS and OS rates of 50% and 62%, respectively, but the follow-up was too short.[47]

- There have been several studies regarding reduced-intensity chemotherapy (RIC) and allogeneic HSCT.[45] Khouri et al. reported on results of RIC allogeneic HSCT in 18 patients with mantle cell lymphoma, and after a median follow-up of 26 months, the actuarial probability of EFS was 82% at 3 years.[48] Maris et al. evaluated allogeneic HSCT in 33 patients with relapsed and recurrent mantle cell lymphoma. At 2 years, the relapse and nonrelapse mortality rates were 9% and 24%, respectively, and the OS and DFS were 65% and 60%, respectively.[49] Cook et al. retrospectively evaluated outcomes of RIC allogeneic HSCT in 70 MCL patients. The 5-year overall survival (OS) and progression-free survival (PFS) rates were 37% and 14% respectively. The 1- and 5-year non-relapse mortality (NRM) was 18% and 21% respectively.[50]

- Till et al. reported the results of the outcomes of 56 patients with MCL, treated with high-dose induction chemotherapy with cyclophosphamide, vincristine, doxorubicin, and dexamethasone (HyperCVAD) with or without rituximab followed by autologous HSCT in first CR or PR (n=21), cyclophosphamide, doxorubicin (or Adriamycin), vincristine (Oncovin), and prednisolone (CHOP) with or without rituximab followed by autologous HSCT in first CR or PR (n=15), or autologous HSCT following disease progression (n=20).[51] 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=.0006).

  Geisler et al. reported on 160 previously untreated patients with MCL with dose-intensified induction immunochemotherapy.[52] Responders received HDC 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 intensive induction chemotherapy, with an overall response rate of 74%.[53] 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.

  Budde et al. evaluated outcomes of 118 consecutive patients with MCL who received a high-dose induction regimen before autologous HSCT. The authors report that the intensive induction regimen was not associated with improved survival in the overall study population or any of the subgroups

(i.e., patients who underwent autologous HSCT as initial consolidation, or patients under 60 years of age).[54]

A review article summarizes the literature on high-dose therapy for mantle cell lymphoma, and a repeat finding in several studies has been a superior result of transplantation in first CR (autologous or allogeneic) rather than in the relapsed setting.[11]

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)

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

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.[55] Nineteen of 26 patients who showed CR or partial response to induction therapy received an autotransplant. At 2 years post-transplant, OS, PFS, and DFS were 84%, 56%, and 63%, respectively.

The role of SCT in peripheral T-cell lymphoma is not well defined. Few studies have been conducted, mostly retrospectively and with small numbers of patients.[56-69] 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.

Clinical Practice Guidelines

Guidelines from the National Comprehensive Cancer Network offer the following on the use of HSCT in NHL:[5]

Follicular Lymphoma/Indolent Lymphomas

- Autologous and allogeneic (fully myeloablative or nonmyeloablative) HSCT in (the latter in highly selected patients only) are recommended as consolidative therapy for patients in second or subsequent remission (category 2A recommendation).

Diffuse Large B-cell Lymphoma

- Autologous HSCT is recommended as first-line consolidation only in high-risk patients, or in those enrolled in a clinical trial. (category 2B)
- Autologous HSCT is recommended for treatment of relapsed or refractory disease. (category 2A)

Mantle Cell Lymphoma

- Autologous HSCT is recommended as first-line consolidative therapy. (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)

Summary

Randomized controlled trials have not shown survival benefit of hematopoietic stem-cell transplantation (HSCT) as initial therapy (i.e., without a full course of standard-dose induction chemotherapy) for treatment of non-Hodgkin lymphomas (NLH). Therefore, HSCT (autologous or allogeneic) is considered investigational for this indication.

Randomized controlled trials have shown survival benefit (overall survival and/or progression-free survival) of hematopoietic stem-cell transplantation (HSCT) as a first-line therapy and therapy for relapsed non-Hodgkin lymphomas (NHL). Therefore, HSCT (autologous or allogeneic) for these indications may be considered medically necessary.

No randomized studies have been conducted on the use of tandem hematopoietic stem-cell transplantation (HSCT) for the treatment of non-Hodgkin lymphomas. The published evidence includes studies with small numbers of patients and is insufficient to establish safety and efficacy of this treatment. Therefore, tandem HSCT is considered investigational to treat patients with any stage, grade, or subtype of Non-Hodgkin Lymphomas.

[70]

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CROSS REFERENCES

Donor Lymphocyte Infusion for Malignancies Treated with an Allogeneic Hematopoietic Stem-Cell Transplant, Transplant, Policy No. 45.03

Placental and Umbilical Cord Blood as a Source of Stem Cells, Transplant, Policy No. 45.16

Hematopoietic Stem Cell Transplantation for Hodgkin Lymphoma, Transplant, Policy No. 45.30

Hematopoietic Stem Cell Transplantation for Chronic Lymphocytic Leukemia and Small Lymphocytic Lymphoma, Transplant, Policy No. 45.35

Hematopoietic Stem-Cell Transplantation for Primary Amyloidosis or Waldenstrom Macroglobulinemia, Transplant, Policy No. 45.40

CODES	NUMBER	DESCRIPTION
CPT	38204	Management of recipient hematopoietic cell donor search and cell acquisition
	38205	Blood-derived hematopoietic progenitor cell harvesting for transplantation, per collection, allogeneic
	38206	;autologous
	38207	Transplant preparation of hematopoietic progenitor cells; cryopreservation and storage
	38208	;thawing of previously frozen harvest, without washing, per donor
	38209	;thawing of previously frozen harvest with washing, per donor
	38210	;specific cell depletion with harvest, T cell depletion
	38211	;tumor cell depletion
	38212	;red blood cell removal
	38213	;platelet depletion
	38214	;plasma (volume) depletion
	38215	;cell concentration in plasma, mononuclear, or buffy coat layer
	38220	Bone marrow; aspiration only
	38221	Bone marrow; biopsy, needle or trocar
	38230	Bone marrow harvesting for transplantation; allogeneic
	38232	Bone marrow harvesting for transplantation; autologous
	38240	Hematopoietic progenitor cell (HPC); allogeneic transplantation per donor
	38241	;autologous transplantation
	38243	;HPC boost
	38242	Allogeneic lymphocyte infusions
HCPCS	J9000–J9999	Chemotherapy drugs code range
	Q0083–Q0085	Chemotherapy administration code range

CODES	NUMBER	DESCRIPTION
	S2140	Cord blood harvesting for transplantation; allogeneic
	S2142	Cord blood derived stem-cell transplantation, allogeneic
	S2150	Bone marrow or blood-derived peripheral stem-cell harvesting and transplantation, allogeneic or autologous, including pheresis, high-dose chemotherapy, and the number of days of post-transplant care in the global definition (including drugs; hospitalization; medical surgical, diagnostic and emergency services)