# 📚 HEMATOLOGY AND ONCOLOGY FOR USMLE 📚

## Non-Hodgkin Lymphoma

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### 📌 Definition

Non-Hodgkin lymphoma (NHL) is a heterogeneous group of lymphoid malignancies arising from B cells (most common) or T cells. Unlike Hodgkin lymphoma, NHL:

- Does NOT contain Reed-Sternberg cells
- Often spreads non-contiguously
- Commonly involves extranodal sites
- Mesenteric lymphadenopathy is common

📌 ~85-90% are B-cell neoplasms

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## 🔬 Neoplasms of Mature B Cells

# 1️⃣ Burkitt Lymphoma

## 🧬 Genetics

t(8;14)

→ c-MYC (chromosome 8) translocated next to Ig heavy chain gene (chromosome 14)

→ Overexpression of c-MYC

→ Uncontrolled proliferation ⚡

Other variants:

- t(2;8) ($\kappa$ light chain)
- t(8;22) ($\lambda$ light chain)

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## 🧠 Pathophysiology (Why is it so aggressive?)

c-MYC overexpression → Increased transcription of growth-related genes → Rapid B-cell proliferation → High mitotic rate → High tumor turnover

High turnover → Many apoptotic cells → Macrophages engulf debris → "Starry sky" appearance 🌟

## 🔬 Histology

Sheets of uniform lymphocytes

- Interspersed tingible body macrophages
- Classic "Starry sky" pattern

## 📍 Clinical Forms

| Form | Population | Site | Association |
|---|---|---|---|
| Endemic | African children | Jaw | EBV 🌍 |
| Sporadic | Worldwide | Abdomen/pelvis | ± EBV |
| Immunodeficiency | HIV patients | Nodes/CNS | EBV |

## 🎯 USMLE Pearls

- Very high Ki-67 (almost 100%)
- Rapidly growing tumor
- Risk of tumor lysis syndrome ⚠️
- Jaw mass in African child = think Burkitt

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## 2️⃣ Diffuse Large B-Cell Lymphoma (DLBCL)

📌 Most common NHL in adults

Usually older adults (but 20% in children)

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### 🧬 Genetics

- BCL-2 mutations
- BCL-6 mutations

BCL-6 → regulates germinal center formation

Mutation → uncontrolled B-cell growth

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### 🧠 Pathophysiology

Germinal center B-cell mutation → Loss of apoptosis control → Diffuse proliferation of large atypical B cells → Effacement of lymph node architecture

"Diffuse" = no follicle formation

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🩺 Clinical

- Rapidly enlarging lymph node
- Can involve extranodal sites (GI tract, CNS)

📌 Aggressive but potentially curable with R-CHOP

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## 3️⃣ Follicular Lymphoma

🧬 Genetics

t(14;18)

- Ig heavy chain (14) + BCL-2 (18)
- Overexpression of BCL-2

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## 🧠 Pathophysiology

BCL-2 normally inhibits apoptosis

Overexpression → Cells do NOT die → Accumulation of B cells → Indolent lymphoma 🐢

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## 🩺 Clinical Features

- Painless lymphadenopathy
- "Waxing and waning" course
- Often widespread at diagnosis

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## 📊 Comparison: Burkitt vs Follicular

| Feature | Burkitt | Follicular |
| --- | --- | --- |
| Genetics | t(8;14) | t(14;18) |
| Oncogene | c-MYC | BCL-2 |

| | | |
|---|---|---|
| Behavior | Very aggressive ⚡ | Indolent 🐢 |
| Histology | Starry sky | Follicular pattern |

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### 🎯 Exam Trap

Reactive follicles = BCL-2 negative

Follicular lymphoma = BCL-2 positive

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## 4️⃣ Mantle Cell Lymphoma

### 🧬 Genetics

t(11;14)

→ Cyclin D1 (11) + Ig heavy chain (14)

→ Cyclin D1 overexpression

→ Increased G1 → S transition

CD5+ (important marker)

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### 🧠 Mechanism

Cyclin D1 overexpression → Increased cell cycle progression → Uncontrolled proliferation → Highly aggressive behavior 🔥

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### 🩺 Clinical

- Older males >> females
- Often late-stage at diagnosis
- Poor prognosis

📌 Think: CD5+ B cell lymphoma (also seen in CLL)

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## 🇸 Marginal Zone Lymphoma (MALT Lymphoma)

### 🧬 Genetics

t(11;18)

## 🧠 Pathophysiology

Chronic inflammation → Persistent antigen stimulation → B-cell proliferation → Malignant transformation

Example:

H. pylori infection
- Chronic gastritis
- MALT formation
- Lymphoma

Eradicate H. pylori → Tumor regression in early cases 🔄

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## 📍 Associations

- Sjögren syndrome
- Hashimoto thyroiditis
- Chronic gastritis

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# 6️⃣ Primary CNS Lymphoma

## 🧬 Association

- EBV related
- HIV/AIDS
- AIDS-defining illness

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## 🧠 Mechanism

Immunosuppression → Impaired immune surveillance → EBV-driven B-cell proliferation → CNS tumor formation

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## 🩺 Presentation

- Confusion
- Memory loss
- Seizures

MRI:

Single ring-enhancing lesion 🧠

⚠️ Must differentiate from toxoplasmosis via CSF or biopsy

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## 🔬 Neoplasms of Mature T Cells

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### 7️⃣ Adult T-Cell Lymphoma/Leukemia

#### 🧬 Cause

HTLV-1 infection

(Common in Japan, West Africa, Caribbean)

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#### 🧠 Pathophysiology

HTLV-1 infection → Viral Tax protein → T-cell proliferation → Malignant transformation

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#### 🩺 Clinical

- Cutaneous lesions
- Lytic bone lesions
- Hypercalcemia

📌 "T-cell in Tokyo"

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## 8️⃣ Cutaneous T-Cell Lymphoma (Mycosis Fungoides)

Most common subtype of cutaneous T-cell lymphoma.

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### 🧠 Disease Progression

Erythematous patches (sun-protected areas) → Plaques → Tumors

Chronic, slow progression

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### 📌 Key Features

- Skin involvement ± blood/lymph nodes
- Can progress to Sézary syndrome (circulating malignant T cells)

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## 📊 High-Yield Summary Table

| Lymphoma | Translocation | Key Gene | Behavior |
|---|---|---|---|
| Burkitt | t(8;14) | c-MYC | Very aggressive |
| Follicular | t(14;18) | BCL-2 | Indolent |
| Mantle cell | t(11;14) | Cyclin D1 | Aggressive |
| Marginal zone | t(11;18) | MALT pathway | Indolent |
| DLBCL | Variable | BCL-2/BCL-6 | Aggressive |

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## 🧠 Master Memory Flowchart

Chronic inflammation → Persistent B-cell stimulation → Genetic mutation → Loss of apoptosis OR increased proliferation → Clonal expansion → Lymphoma formation

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## 🎯 USMLE Points

- Most common adult NHL → DLBCL
- Jaw tumor in African child → Burkitt
- Waxing/waning nodes → Follicular
- CD5+ B-cell lymphoma → Mantle cell
- H. pylori regression → MALT
- AIDS + ring lesion → Primary CNS lymphoma

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-> The End <-