original contributions

Utility of Routine Surveillance Laboratory Testing in Detecting Relapse in Patients With Classic Hodgkin Lymphoma in First Remission: Results From a Large Single-Institution Study

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QUESTION ASKED: What is the role of surveillance laboratory testing for the detection of relapse in patients with classic Hodgkin lymphoma (CHL) in complete remission?

SUMMARY ANSWER: We found that surveillance laboratory testing had limited utility in the detection of relapse of classic Hodgkin lymphoma (CHL). The sensitivity of any surveillance laboratory test for detecting relapse within 3 years of end of treatment was 72.7% (95% CI: 49.8% to 89.3%), specificity 22.6% (17.2% to 28.9%), yielding a PPV of 8.9% (95% CI: 7.0% to 11.3%) and NPV of 88.9% (79% to 94%).

WHAT WE DID: We conducted a retrospective cohort study of patients with newly diagnosed CHL who were treated with the Stanford V regimen at our institution both on and off protocol between 1998 and 2014. Eligibility criteria for this study included patients with a complete remission to primary therapy that lasted at least 3 months with evidence of at least one surveillance visit or laboratory test while in remission. Those with primary progressive CHL or in a partial remission at the end of first-line treatment were excluded from the analysis. Patients who received primary chemotherapy and/or follow-up care outside our institution were also excluded. Data were abstracted from electronic health records for patient demographics, treatment regimen, follow-up laboratory testing data, biopsy if any and imaging dates, reasons prompting a biopsy, and relapse information. An algorithm to define laboratory tests as surveillance was developed by the study team; the algorithm was created to conform to surveillance guidelines at the time the testing was performed. Specifically, a laboratory test was classified as part of surveillance if it was done prior to relapse date, first biopsy date, or death date (if relapsed or died) and if it met the condition of minimum number of weeks from the previous laboratory test. For each surveillance laboratory component, we assessed if the test result was normal or abnormal based on test result values. For laboratory tests that could be categorized based on the Common Terminology Criteria for Adverse Events (CTCAE) version 4.03, we defined an abnormal laboratory component as one that was at least grade 2. For tests that do not have a CTCAE grading scale, any value outside the normal range was defined as abnormal for the purposes of this analysis. If a patient had at least one abnormal surveillance laboratory component prior to a biopsy, the patient was classified as having an abnormal surveillance laboratory test.

WHAT WE FOUND: We identified 235 patients who met our inclusion criteria. We found that abnormal laboratory testing had low PPV and no clinically meaningful specificity for the detection of relapse. We also performed subset analyses to try and identify laboratory tests or risk factors that might improve the utility of this testing, but the results were similar.

BIAS, CONFOUNDING FACTORS: This was a retrospective analysis from a single center, and patients who had follow-up outside the site could not be analyzed.

REAL-LIFE IMPLICATIONS: Surveillance laboratory testing appeared to have limited meaningful impact in detecting relapse in patients with Hodgkin lymphoma in remission. These results are provocative and worthy of discussion by guideline committees if modifications to current guidelines are warranted.

ASSOCIATED CONTENT
Appendix

Author affiliations and disclosures are available with the complete article at ascopubs.org/journal/op.

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CARE DELIVERY

original contributions

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abstract

PURPOSE Classic Hodgkin lymphoma is highly curable with contemporary therapy. Although the limited role of surveillance imaging to detect early relapse for patients in complete remission at the end of therapy is well established, there is a paucity of data regarding role of laboratory testing in this setting.

METHODS Patients with newly diagnosed classic Hodgkin lymphoma uniformly treated with the Stanford V regimen from 1998-2014 and in complete remission for at least 3 months were identified in a single-center institutional database. Laboratory tests categorized by Common Terminology Criteria for Adverse Events v4.03 as grade 2 or higher were considered abnormal. Primary analysis included sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of surveillance laboratory tests for predicting relapse in the first 3 years after end of treatment.

RESULTS Among 235 eligible patients, 24 (10.2%) patients ultimately relapsed. In the first 3 years after end of therapy, the mean number of surveillance blood draws per patient was 7.1, (range, 1-13). These 1,661 surveillance blood draws included 4,684 individual laboratory tests, comprising 1,609 CBCs, 1,578 metabolic panels, and 1,497 erythrocyte sedimentation rates. None of the biopsies confirming relapses were prompted by any abnormal laboratory finding. The sensitivity of any surveillance laboratory test for detecting relapse within 3 years of end of treatment was 72.7% (95% CI, 49.8% to 89.3%), specificity 22.6% (95% CI, 17.2% to 28.9%), yielding a PPV of 8.9% (95% CI, 7.0% to 11.3%) and NPV of 88.9% (95% CI, 79% to 94%).

CONCLUSION Our study found limited clinically meaningful utility for routine surveillance laboratory testing in detecting relapse in patients with complete remission at end of treatment. Our results warrant consideration of modifications to current practice guidelines.

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INTRODUCTION

Classic Hodgkin lymphoma (CHL) is highly curable, with contemporary front-line therapies in approximately 85%-90% of patients with early-stage[1-4] and 75%-80% of patients with advanced-stage disease.[5-8] Historically, the rationale for surveillance for patients with CHL in first complete remission (CR) had been twofold: to detect early relapse and to evaluate for late effects of primary therapy, such as secondary cancers. Guidelines for surveillance have been carried forward from an era where extended-field and high-dose radiotherapy were the mainstay of primary therapy. Advances over the past three decades include development of safer chemotherapy regimens, reduction in the dose and field of radiation administered, and more accurate staging/response assessment with positron emission tomography/computed tomography (PET/CT). With contemporary regimens, optimal surveillance needs to be redefined to align with the improvements in safety and response assessment. An example of this is the recognition that surveillance imaging, particularly with PET/CT,[9-11] was associated with high costs and few changes in management, which led to the discontinuation of routine imaging in asymptomatic patients in the current National Comprehensive Cancer (NCCN) and European Society of Medical Oncology (ESMO) CHL guidelines.[12,13]

In contrast to imaging guidelines, there is a paucity of data on the utility of routine laboratory testing in the detection of relapse, yet regular laboratory testing still features prominently in international surveillance guidelines. For example, NCCN guidelines recommend

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TABLE 1. Baseline Characteristics of Our Patient Cohort

Baseline Characteristic	Measure
No. of patients	235
Median age, years (range)	32 (17-82)
Sex	
Male	113 (48)
Female	122 (52)
Stage at diagnosis	
I	18 (8)
II	156 (66)
III	36 (15)
IV	25 (11)
Advanced stage (III/IV)	61
IPS ≤ 2	29 (48)
IPS ≥ 3	27 (44)
N/A	5 (8)
Early stage (I/II)	
Favorable	92 (53)
Unfavorable	66 (38)
N/A	16 (9)
B symptoms at diagnosis	69 (29)
No. of patients with at least one site > 5 cm at diagnosis	172 (73)
Patients with bulky mediastinal mass	61 (26)
Elevated ESR (> 50) at diagnosis	63 (27)
Extranodal involvement at diagnosis	61 (26)
Bone	12 (5)
Bone marrow	6 (3)
Chest wall	8 (3)
Liver	6 (3)
Lung	19 (8)
Pleura	5 (2)
Skin	1 (0)
Spleen	22 (9)
Pericardium	24 (10)
Histology	
Nodular sclerosis	180 (77)
Mixed cellularity	22 (9)
Lymphocyte rich	3 (1)
Lymphocyte depleted	0 (0)
Unclassified/other	30 (13)
Weeks of Stanford V given	
8	87 (37)
12	148 (63)
Radiotherapy administered	229 (97)
Radiotherapy omitted	6 (3)
Early stage (I or II)	1 (1)
Advanced stage (III or IV)	5 (8)
Radiation dose given, Gy	
< 30	48 (21)
30-30.6	79 (34)
30.7-35.9	1 (0)
36	97 (42)
> 36	4 (2)
Imaging modality used	
Staging and response by PET	218 (93)
Staging by PET, response by CT	3 (1)
Staging by CT, response by PET	3 (1)
Staging by CT, response by CT	11 (5)

NOTE. Data are presented as No (%) unless otherwise noted.

Abbreviations: CT, computed tomography; ESR, erythrocyte sedimentation rate; IPS, International Prognostic Score; PET, positron emission tomography.

a CBC, erythrocyte sedimentation rate (ESR, if elevated at diagnosis), and chemistry panel "if clinically indicated."[12] ESMO guidelines recommend laboratory testing including CBC, ESR, and chemistry panel every 3 months for the first half year, then every 6 months until year 4, and yearly thereafter.[13]

The objective of our study was to assess if routine surveillance laboratory tests in patients treated with curative intent and in CR were useful in detecting relapse in patients with CHL in the absence of clinical signs or symptoms.

METHODS

We conducted a retrospective cohort study of patients with newly diagnosed CHL who were treated with the Stanford V[1,14] regimen at our institution both on and off protocol between 1998 and 2014. Patients were identified from the Stanford lymphoma database, which includes detailed baseline and treatment information on all patients with lymphoma who have been seen in clinic at the institution. Eligibility criteria for this study included patients with a CR to primary therapy that lasted at least 3 months, with evidence of at least one surveillance visit or laboratory test while in remission. Those with primary progressive CHL or in a partial remission (PR) at the end of first-line treatment were excluded from the analysis. Patients who received primary chemotherapy and/or follow-up care outside our institution were also excluded. Data were abstracted from electronic health records for patient demographics, treatment regimen, follow-up laboratory testing data, biopsy if any and imaging dates, reasons prompting a biopsy, and relapse information. Follow-up data were collected up to 5 years after primary treatment completion. Data on death

dates are imported into our database from the California Cancer Registry or from medical records.

Date of treatment completion was defined using the last date of radiation; if a patient did not receive radiation, the last date of chemotherapy was used as the date of treatment completion.

Patients were followed according to institutional guidelines, which included clinic visits and laboratory tests approximately every 3 months for years 1-2, and every 6 months for years 3-5. Laboratory data (test date, laboratory components, and results) were captured from our electronic medical records. We included laboratory components from the CBC, ESR, and chemistry panels. Specific components analyzed included WBC, hemoglobin, platelets, absolute lymphocyte count (ALC), absolute neutrophil count (ANC), albumin, AST, alanine aminotransferase, and total bilirubin. The study was approved by the Stanford Institutional Review Board.

An algorithm to define laboratory tests as surveillance was developed by the study team; the algorithm was created to conform to surveillance guidelines at the time the testing was performed. Specifically, a laboratory test was classified as part of surveillance if it was done before relapse date, first biopsy date, or death date (if relapsed or died) and if it met the condition of minimum number of weeks from the previous laboratory test. Surveillance laboratory tests were defined based on the calendar year of treatment completion, the year of follow-up, and the timing of expected surveillance laboratory tests after treatment. For example, for the period 1998-2009, during the first year of surveillance, a laboratory test had to have been done at least 6 weeks after treatment completion or after the previous laboratory test to be defined as a surveillance test. During the second year of surveillance, this timing changed to at least 8 weeks from the previous laboratory tests for a test to be classified as a surveillance test; tests conducted before 8 weeks were not considered surveillance.

For each surveillance laboratory component, we assessed if the test result was normal or abnormal on the basis of test result values. For laboratory tests that could be categorized based on the Common Terminology Criteria for Adverse Events (CTCAE) version 4.03, we defined an abnormal laboratory component as one that was at least grade 2. For tests that do not have a CTCAE grading scale (elevated WBC, elevated ANC, elevated platelets, and elevated ESR), any value outside the normal range was defined as abnormal for the purposes of this analysis. If a patient had at least one abnormal surveillance laboratory component before a biopsy, the patient was classified as having an abnormal surveillance laboratory test.

The primary goals for this study were to estimate the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of any surveillance laboratory tests for relapse detection within the first 3 years of follow-up. If any surveillance laboratory test in the 3-year period after treatment completion was abnormal, the patient was classified as having an abnormal surveillance laboratory test. The gold standard for this analysis was the presence of a biopsy-proven relapse or initiation of subsequent therapy (for patients without a biopsy-proven relapse). The 95% CIs for sensitivity and specificity were calculated using the Clopper-Pearson confidence intervals[15] and for the PPV and NPV using standard logit confidence intervals.[16] The secondary goals were to estimate the sensitivity, specificity, PPV, and NPV of surveillance laboratory tests for relapse detection within the first 3 years of follow-up in specific subsets of patients on the basis of the following baseline risk factors: (1) elevated ESR ($>$ 30 mm/h) at diagnosis/nonelevated ESR at diagnosis; (2) early stage (stage I-II) favorable/unfavorable (per European Organisation for Research and Treatment of Cancer criteria); (3) early stage bulky ($>$ 10 cm or mediastinal mass ratio $>$ 0.33)/nonbulky; (4) advanced stage (stage III-IV) International Prognostic Score (IPS) 0-2/IPS 3-7. After observing the high frequency of abnormal ALC and ESR, post hoc analyses were performed to estimate sensitivity, specificity, PPV, and NPV of (1) only ESR surveillance laboratory tests, and (2) surveillance laboratory tests after excluding ALC. Analyses were conducted using SAS v 9.4 (SAS Institute, Cary, NC) and R package.[17]

RESULTS

Between January 1998 and December 2014, 235 patients with newly diagnosed CHL met the eligibility criteria for our study. The median age was 32 years (range, 18-82 years), and 174 (74.1%) had early-stage disease (Table 1). Two hundred twenty-one patients (94%) had their end-of-treatment response assessment by PET/CT. Twenty-four patients (10%) relapsed at a median time from end of treatment of 8 months (range, 3.4-80.5 months). One hundred ninety-four patients (83%) had at least 3 years of follow-up at our institution (Table 1).

The median number of blood draws per patient over the 3 years examined was 8 (interquartile range, 5-13). Overall there were a total of 1,661 surveillance blood draws, which included 1,609 CBCs, 1,578 basic metabolic panels, and 1,497 ESRs. One hundred eighty (77%) patients had at least one abnormal laboratory component by our definition over the first 3 years of follow-up. Figure 1 shows the distribution of laboratory testing by patient. There were several more abnormal tests in the first few weeks after treatment completion, which became less frequent over time, and very few patients had relapse.

The frequency of specific abnormal laboratory components is listed in Table 2. Notably, the ALC was abnormal 25% of the time and ESR was abnormal 9.6% of the time. All other components analyzed were infrequently abnormal, ranging from 0.1%-3.6%. A swimmer's plot in Figure 2 illustrates

the patterns of abnormal testing performed on all patients who subsequently relapsed.

For our primary analysis, 234 patients had at least one surveillance laboratory test during the first 3 years of follow-up, of whom 22 (9.4%) relapsed during the first 3 years of follow-up (Table 3). Any surveillance laboratory test had a sensitivity of 72.7% (95% CI, 49.8% to 89.3%), specificity of 22.6% (95% CI, 17.2% to 28.9%), PPV of 8.9% (95% CI, 7.0% to 11.3%), and NPV of 88.9% (95% CI, 79.4% to 94.3%). Excluding ALC from the analysis yielded a PPV of 10.8% (95% CI, 7.5% to 15.4%), and only using ESR yielded a PPV of 16.4% (95% CI, 11.2% to 23.4%; Table 3).

The results of our secondary analyses on patient subsets are shown in Table 3. The PPV remained low in patients with adverse risk characteristics at diagnosis, including patients with elevated ESR (16.2%; 95% CI, 9.9% to 25.3%), early-stage unfavorable (24.1%; 95% CI, 15.5% to 35.6%), early-stage bulky (14.3%; 95% CI, 10.6% to 19.1%), and advanced-stage disease with IPS $>$ 2 (7.1%; 95% CI, 1.3% to 30.3%).

Forty-one patients had a biopsy for suspected relapse, of which 23 confirmed relapsed disease. One patient proceeded with subsequent therapy on the basis of highly suspicious imaging findings in an area that could not easily undergo biopsy. However, none of the patients who had a biopsy or relapsed had additional work-up prompted by an abnormal laboratory value. Surveillance imaging prompted the biopsy for most patients (27/41; 66%), regardless of whether the patient eventually relapsed or not (Appendix Table A1, online only).

DISCUSSION

In this single-center, retrospective review of patients with uniformly treated CHL who achieved a CR after primary therapy, we found that surveillance laboratory tests had minimal impact in detecting relapse or altering patient management. Surveillance laboratory testing was not associated with clinically meaningful sensitivity, specificity, PPV, and NPV.[18] Despite the time and resources that went into this testing, none of the patients in our cohort had a biopsy prompted by an abnormal laboratory test result; most biopsies were prompted as a result of surveillance imaging.

We designed our study to use clinically meaningful definitions for abnormal laboratory tests to avoid minimally

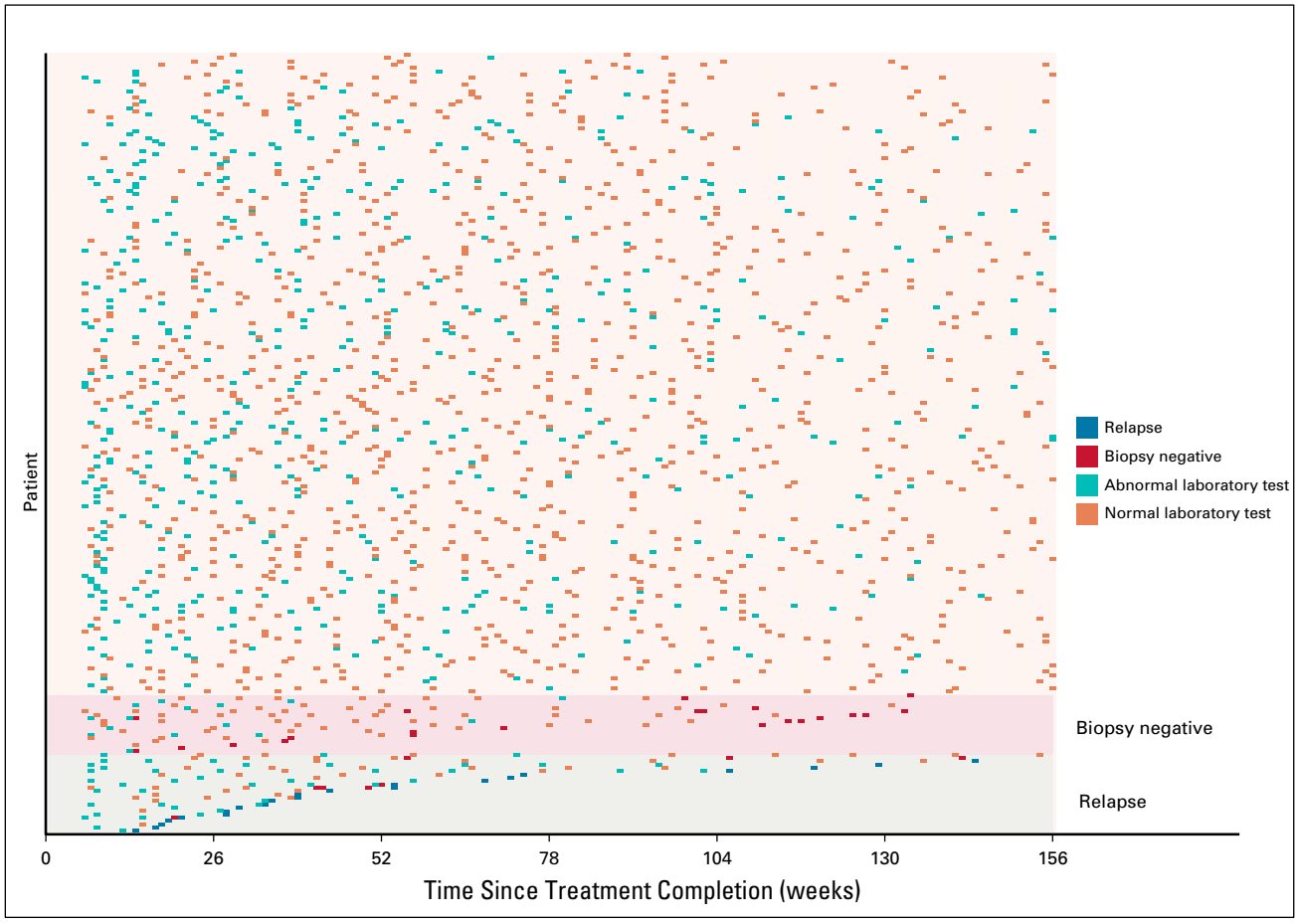

FIG 1. Surveillance laboratory testing over 3 years.

TABLE 2. Frequency of Abnormal Surveillance Laboratory Components

Component	Total Tested	Abnormal No. (%)
ALC	1,594	399 (25.0)
ESR	1,499	144 (9.6)
ANC	1,600	58 (3.6)
WBC	1,612	33 (2.0)
AST	1,440	12 (0.8)
Total bilirubin	1,430	11 (0.8)
Platelets	1,612	12 (0.7)
ALT	1,358	8 (0.6)
Albumin	1,432	7 (0.5)
Alkaline phosphatase	1,577	1 (0.1)
Hemoglobin	1,614	1 (0.1)

Abbreviations: ALC, absolute lymphocyte count; ALT, alanine aminotransferase; ANC, absolute neutrophil count; ESR, erythrocyte sedimentation rate.

abnormal results skewing our analysis. The CTCAE grading system allowed us to systematically evaluate each laboratory component and only identify grade 2 or higher laboratory values as abnormal. Despite the stringent criteria, 180 (77%) patients had at least one abnormal laboratory test by our criteria during the first 3 years of follow-up.

Few studies have focused on the role of laboratory testing for survivors of CHL. Isolated detection of relapse by ESR has been described in few studies.[19,20] A Stanford study of 709 patients with early-stage CHL treated with primary radiotherapy between 1969 and 1994 found that 157 (22%) patients relapsed, of whom only one had a relapse detected based on an abnormal ESR.[19] A separate older single-center series of 107 patients and 22 relapses found 2 occurrences of an abnormal laboratory test prompting the detection of relapse.[20]

Our results are also comparable to a report of a combined analysis of patients with CHL or non-Hodgkin lymphoma by Hawkes et a,l[21] in which there were few changes in management on the basis of laboratory abnormalities and no difference in survival between patients with or without laboratory abnormalities in the 3 months before relapse. Although the analysis by Hawkes et al[21] did not use the same stringent criteria for defining an abnormal blood test in their analysis, the NPV seen in our primary and secondary analyses were comparable, suggesting that excluding mildly abnormal laboratory tests did not affect our analysis.

We found a high rate of lymphopenia in our cohort, with 25% of laboratory values grade 2 or higher. Lymphopenia after a chemotherapy regimen like Stanford V is well described and related to the prednisone used as part of the regimen.[6] Because of this finding, we performed a post hoc analysis that excluded this laboratory component and found similar results to our primary analysis.

We also did not see a substantial difference in the PPV in higher-risk cohorts where the likelihood of treatment failure

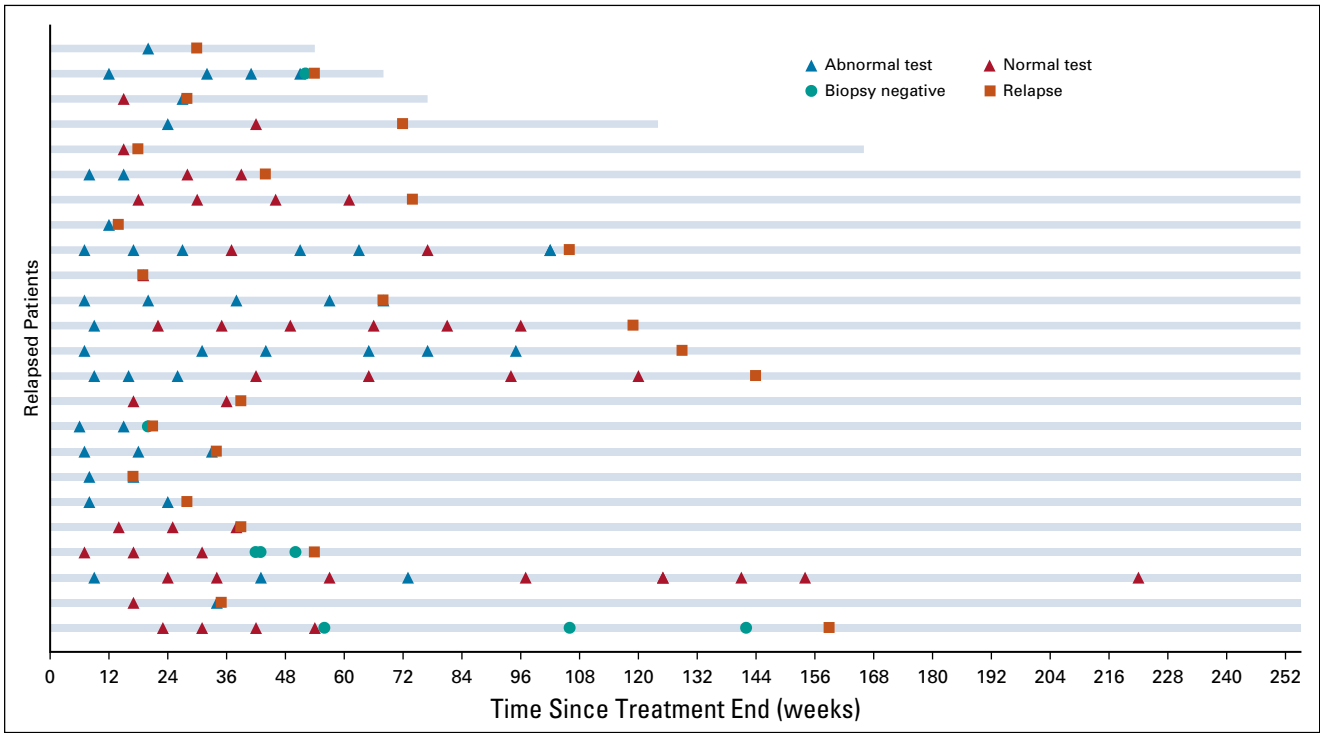

FIG 2. Swimmer's plot of the data from Figure 1 for relapsed patients only. One patient relapsed at week 350.

TABLE 3. Sensitivity, Specificity, PPV, and NPV of Surveillance Laboratory Testing and Relapse Within 3 Years of Treatment Completion Based on Baseline Characteristics

Characteristic	Total No.	Relapse No. (%)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Overall cohort/any surveillance laboratory test	234	22 (9)	72.7	22.6	8.9	88.9
			(49.8 to 89.3)	(17.2 to 28.9)	(7.0 to 11.3)	(79.4 to 94.3)
Excluding ALC			54.6	53.3	10.8	91.9
			(32.2 to 75.6)	(46.3 to 60.2)	(7.5 to 15.4)	(87.5 to 94.8)
Only ESR			57.9	73.1	16.4	95
			(33.5 to 79.8)	(66.5 to 79.0)	(11.2 to 23.4)	(91.8 to 97.0)
Subset analyses by baseline risk group						
All patients						
ESR at diagnosis > 30 mm/h	69	10 (15)	60	47.5	16.2	87.5
			(26.2 to 87.8)	(34.3 to 60.9)	(9.9 to 25.3)	(75.8 to 94.0)
ESR at diagnosis ≤ 30 mm/h	65	2 (3)	50	66.7	4.6	97.7
			(1.3 to 98.7)	(53.7 to 78.1)	(1.1 to 16.6)	(91.2 to 99.4)
Early stage						
Favorable	92	4 (4)	25	55.7	2.5	94.2
			(0.6 to 80.6)	(44.7 to 66.3)	(0.5 to 12.5)	(90.0 to 96.7)
Unfavorable	66	11 (17)	63.6	60	24.1	89.2
			(30.8 to 89.1)	(45.9 to 73.0)	(15.5 to 35.6)	(78.6 to 94.9)
Bulky (any site > 10 cm and/or MMR > 0.33)	44	3 (7)	100	56.1	14.3	100
			(29.2 to 100.0)	(39.8 to 71.5)	(10.6 to 19.1)	
Nonbulky	103	10 (10)	40	51.6	8.2	88.9
			(12.2 to 73.8)	(41.0 to 62.1)	(3.9 to 16.4)	(82.3 to 93.2)
Advanced stage						
IPS 0-2	29	3 (10)	100	50	18.8	100
			(29.2 to 100.0)	(29.9 to 70.1)	(13.6 to 25.3)	
IPS 3-7	27	4 (15)	25	40.9	7.1	75
			(0.6 to 80.6)	(20.7 to 63.7)	(1.3 to 30.3)	(58.5 to 86.5)

NOTE. The overall cohort analyses were repeated excluding ALC as well as using ESR only. Subset analyses of high-risk patients for any surveillance laboratory were also performed.

Abbreviations: ALC, absolute lymphocyte count; ESR, erythrocyte sedimentation rate; IPS, International Prognostic Score; MMR, mediastinal mass ratio; NPV, negative predictive value; PPV, positive predictive value.

is greater. Although only 9% of the overall cohort relapsed within 3 years, the rates of relapse in higher-risk patients were similar. For this reason, we found no impact of an elevated ESR at diagnosis (15%), early-stage unfavorable (17%), early-stage bulky (7%), and advanced-stage IPS > 2 (15%). One caveat is that we included only patients who achieved a CR for at least 3 months. Therefore, many of the treatment failures in the high-risk subgroup may have occurred before this time and therefore would not have been included in our analysis.

Although one of the strengths of our study is that patients were treated uniformly, there are limitations related to the retrospective nature of the analysis and laboratory data decoupled from the clinic visit, which required an algorithm to identify laboratory testing performed for surveillance. We also could not identify if any additional laboratory testing might have been performed outside our institution. In addition, patients with advanced-stage disease were under-represented in our cohort compared with early stage. However, the main driver of the poor utility of surveillance laboratory testing is the low relapse rate, and in Table 3 the rates of relapse were similar between patients with early- and advanced-stage disease. Although Stanford V is not widely used outside of our institution, in a randomized phase III study there was not significant difference in outcomes when compared with the more commonly used doxorubicin, bleomycin, vinblastine, dacarbazine (ABVD) regimen.[6] Therefore, we believe the results of this study can be extrapolated to ABVD and ABVD-like regimens.

To our knowledge, this is the largest study examining the utility of surveillance laboratory testing on patients with CHL treated with contemporary therapy. Despite restricting our cohort to patients in whom surveillance testing would likely be beneficial, we were unable to find a clear benefit in asymptomatic patients. Although the high NPV of surveillance testing may provide reassurance to patients, 77% of patients had at least one abnormal blood test, whereas only 9% ultimately relapsed. This high rate of unexplained abnormality seen in our study and others leads to a poor PPV in asymptomatic patients and unnecessary patient anxiety[22] and may lead to additional imaging and biopsy procedures.

We believe that our results are provocative, and we hope they will be discussed by guideline committees across the globe (NCCN and ESMO) when recommendations for surveillance are being considered. Although surveillance laboratories may be useful in select settings (eg, monitoring for hypothyroidism in patients treated with neck radiation), these results do not justify their routine use in the detection of relapse. Preliminary results of novel methods of relapse detection such as circulating tumor DNA may prove to be more sensitive/specific, and larger studies are required to validate these results before they can be incorporated clinically.[23]

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST AND DATA AVAILABILITY STATEMENT

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Manuscript writing: All authors
Final approval of manuscript: All authors
Accountable for all aspects of the work: All authors

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Utility of Routine Surveillance Laboratory Testing in Detecting Relapse in Patients With Classic Hodgkin Lymphoma in First Remission: Results From a Large Single-Institution Study

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APPENDIX

TABLE A1. Patients Who Had Biopsy During the Course of Surveillance Sorted by Eventual Relapse as Well as Reason for the Work-Up That Initially Prompted the First Biopsy

Reason for First Biopsy	Total (N = 41)	Eventual Biopsy-Positive for CHL (n = 23)	Biopsy-Negative for CHL (n = 18)
Asymptomatic surveillance imaging test	27 (66)	15 (65)	12 (67)
Patient symptoms only	8 (20)	6 (26)	2 (11)
Abnormal physical examination only	3 (7)	1 (4)	2 (11)
Symptoms + physical examination	3 (7)	1 (4)	2 (11)
Surveillance laboratory testing	0 (0)	0 (0)	0 (0)

NOTE. For example, a patient who contacts their provider with symptoms concerning for relapse then subsequently has an abnormal scan would be counted under "patient symptoms only" and not "surveillance imaging test."

Abbreviation: CHL, classic Hodgkin lymphoma.