Recent Evolution in the Management of Lymph Node Metastases in Melanoma

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ABSTRACT

Introduction. Based upon two large randomized international clinical trials (German Dermatologic Cooperative Oncology Group (DeCOG-SLT) and Multicenter Selective Lymphadenectomy Trial II (MSLT-II)) published in 2016 and 2017, respectively, active surveillance has been demonstrated to have equivalent survival outcomes to completion lymphadenectomy (CLND) for a subset of patients who have microscopic lymph node disease. In this study, the changes in national practice patterns were examined regarding the utilization of CLND after positive sentinel lymph node biopsy (SLNB).

Methods. Using the National Cancer Database, CLND utilization was examined in SLN-positive patients diagnosed with melanoma between 2012 and 2016. A hierarchal logistical regression model with hospital-level random intercepts was constructed to examine the factors associated with SLNB followed by observation vs. SLNB with CLND.

Results. Of the 148,982 patients identified, 43% (n = 63,358) underwent SLNB and 10.3% (n = 6,551) had a SLNB with microscopic disease. CLND was performed for 57% (n = 2,817) of these patients. Patients were more likely to undergo CLND if they were ≤ 55 years of age (OR, 1.454; p ≤ 0.0001), ages 56 - 65 (OR, 1.127; p = 0.026), Charlson Deyo Score = 0 (OR, 2.088; p = 0.043), or were diagnosed with melanoma in 2012 (OR, 2.259; p ≤ 0.0001).

Conclusions. The utilization of CLND among patients with microscopic nodal melanoma was significantly lower in 2016 compared to 2012. Younger age, lack of comorbidities, and primary tumor location on the trunk or head/neck were associated with higher utilization of CLND. Kans J Med 2021;14:64-72

INTRODUCTION

Melanoma is a malignant tumor typically of the skin that arises from the proliferation of melanocytes. The incidence of melanoma in the United States has increased from 1980 to 25.83 cases per 100,000 persons in 2012 and 2016, respectively, active surveillance has been demonstrated to have equivalent survival outcomes to completion lymphadenectomy (CLND) for a subset of patients who have microscopic lymph node disease. In this study, the changes in national practice patterns were examined regarding the utilization of CLND after positive sentinel lymph node biopsy (SLNB).

Methods. Using the National Cancer Database, CLND utilization was examined in SLN-positive patients diagnosed with melanoma between 2012 and 2016. A hierarchal logistical regression model with hospital-level random intercepts was constructed to examine the factors associated with SLNB followed by observation vs. SLNB with CLND.

Results. Of the 148,982 patients identified, 43% (n = 63,358) underwent SLNB and 10.3% (n = 6,551) had a SLNB with microscopic disease. CLND was performed for 57% (n = 2,817) of these patients. Patients were more likely to undergo CLND if they were ≤ 55 years of age (OR, 1.454; p ≤ 0.0001), ages 56 - 65 (OR, 1.127; p = 0.026), Charlson Deyo Score = 0 (OR, 2.088; p = 0.043), or were diagnosed with melanoma in 2012 (OR, 2.259; p ≤ 0.0001).

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INTRODUCTION

Melanoma is a malignant tumor typically of the skin that arises from the proliferation of melanocytes. The incidence of melanoma in the United States has increased from 10.51 cases per 100,000 persons in 1980 to 25.83 cases per 100,000 persons in 2016, and is predicted to increase to 31.15 cases per 100,000 persons in 2020. Melanoma can present at any age, with the highest incidence among those aged 60-70 years. The American Cancer Society estimates that 75,150 new cases of melanoma will be diagnosed in the United States in 2021, resulting in an estimated 10,180 deaths. Mortality from melanoma is higher among men and those with larger tumors. Melanoma is the most common cause of death for those with skin of color.

CLND can be associated with high morbidity, with the occurrence of complications ranging from 11% - 73%. Consequently, there have been several studies that have sought to determine if it is safe to avoid CLND for patients following a positive SLNB, including two large randomized control trials (RCTs): the German Dermatologic Cooperative Oncology Group (DeCOG-SLT) and the Multicenter Selective Lymphadenectomy Trial II (MSLT-II). The results of these two RCTs comparing CLND with observation demonstrated no difference in overall survival at three years, suggesting that CLND did not provide additional benefit among patients diagnosed with nodal metastasis. Both trials were limited by relatively short follow-up, and the favorable histologic characteristics of the patients enrolled.

A study evaluating the usage of CLND among patients diagnosed with melanoma from 2004 to 2005 reported that 50% of patients with a positive SLNB underwent a CLND, suggesting that clinicians were foregoing CLND for some patients. However, few studies have examined the practice patterns and trends in the performance of CLND among patients after a positive SLNB, with respect to frequency and patient factors. Our study objectives were to: 1) examine the national trends and practice patterns regarding the utilization of CLND among patients after a positive SLNB, and 2) identify which patient and tumor characteristics were associated with undergoing a CLND and those associated with observation after a positive SLNB.

METHODS

Participants. A cross-sectional study was conducted using the National Cancer Database (NCDB) to include patients 18 years or older who were diagnosed with melanoma between 2012 and 2016, as classified by the World Health Organization’s International Classification of Disease for Oncology (ICD-O), 3rd edition. Patients with metastatic disease, clinically positive lymph nodes, and carcinoma in situ were excluded.

Instrument. This study was considered “Not Human Subjects” by the Human Subjects Committee at the University of Kansas School of Medicine-Wichita. The NCDB, established in 1988, is a joint program of the American College of Surgeons Commission on Cancer (CoC) and the American Cancer Society (ACS) that collects data on approximately 70% of all cancer diagnoses annually. Cases were abstracted from the 2016 NCDB Adult Participant Use Data File, the most recent year of available data. The NCDB Participant Use Data File contains de-identified, Health Insurance Portability, and Accountability Act (HIPPA)-compliant data and are available to investigators affiliated with CoC-accredited programs.
Clinically relevant factors included gender, age (≤55 years, 56–65 years, 66–75 years, >75 years), race (white, non-white), insurance status (private, not insured, Medicaid, Medicare, other government insurance), quartile of median household income (<$38,000, $38,000–$47,999, $48,000–$62,999, and ≥$63,000), the number of comorbid conditions based on the Charlson-Deyo Score (0, 1, 2, and ≥3), year of melanoma diagnosis (2012–2016), Breslow thickness (<1.00 mm, 1.01–2.00 mm, 2.01–4.00 mm, ≥4.01 mm), the presence or absence of ulceration, and the primary location of the tumor (head, trunk, upper extremity, and lower extremity).

**Surgical Procedure and Nodal Evaluation.** The Facility Oncology Registry Data Standards (FORDS) were used to define regional lymph node evaluation and the surgical procedure(s) performed. Before January 1, 2012, the variable, “Scope of Regional LN Surgery”, had been used. However, the coding instructions for this variable led to the inability to distinguish SLNB alone or SLNB + CLND, leading to concerns of the under-reporting of procedures performed. A joint committee comprised of the Commission on Cancer (CoC), National Cancer Institute’s Surveillance Epidemiology and End Results (SEER), and North American Association of Central Cancer Registries (NAACCR) created a new variable, “Scope of Regional LN Surgery 2012”, that created the distinction between type of surgeries performed. “Scope of Regional LN Surgery 2012”, which was used in the current study, was coded as SLNB alone or SLNB with CLND. Cases were abstracted by Certified Tumor Registrars using NAACCR-approved software. Breslow thickness, primary site, and presence or absence of ulceration were evaluated using the Collaborative Stage Data Collection System.

**Statistical Analysis.** Data were analyzed using SAS version 9.4 (SAS Int. Inc., Cary, NC). Frequencies and percentages were reported for all categorical data. A hierarchical logistic regression model with hospital-level random intercepts that accounted for the clustering of patients within hospitals was constructed to examine the factors associated with SLNB followed by observation vs. SLNB with CLND. Cases were abstracted by Certified Tumor Registrars using NAACCR-approved software. Breslow thickness, primary site, and presence or absence of ulceration were evaluated using the Collaborative Stage Data Collection System.

**RESULTS**

A total of 265,127 patients were diagnosed with melanoma between January 1, 2012, and December 31, 2016. After excluding patients with distant metastatic disease, clinically positive lymph nodes, and carcinomas in situ or unknown American Joint Committee on Cancer (AJCC) staging, the final cohort contained 148,982 patients from 1,343 CoC-accredited facilities.

Of these patients, 42.5% (n = 63,358) underwent a SLNB (Table 1). Among patients who underwent a SLNB, 10.3% (n = 6,551) also had at least one lymph node with metastatic disease. Among those with a positive SLNB, 60% (n = 3,928) were male, and their mean age was 59 (SD = 15) years. Fifty-four percent (n = 3,517) of those with a positive SLNB were privately insured, 37% (n = 2,395) had Medicare, and 3% percent (n = 185) were uninsured. For 37% (n = 2,448) of patients, the trunk was the location of the primary site, making it the most common location in those with a positive SLNB. The head region comprised 14% (n = 949) of primary site cases.

Forty-three percent (n = 2,817) of patients with a positive SLNB had no further surgery, whereas 57% (n = 3,737) of patients with a positive SLNB underwent CLND. Among those who underwent CLND, 61% (n = 2,265) were male, and their mean age was 56 (SD = 15) years. Among those who underwent observation after positive SLNB, 59% (n = 1,663) were male, and their mean age was 62 (SD = 16) years. Fifty-nine percent (n = 2,186) of patients who underwent CLND were privately insured, whereas 48% (n = 1,331) of those who underwent observation after a positive SLNB were privately insured. Twenty-six percent (n = 966) of patients who underwent CLND had a Breslow thickness of ≥4.01 mm, whereas 31% (n = 875) of patients who underwent observation after positive SLNB had a Breslow thickness of 2.01–4.00 mm. In the unadjusted analysis, patient sex, age, insurance status, median household income, education, year of diagnosis, Breslow thickness, ulceration, and location were significantly different between individuals forgoing CLND after a positive SLNB and patients receiving a CLND after a positive SLNB (all p values < 0.05). Additional patient and tumor characteristics are detailed in Tables 1 and 2.

**Use of Completion Lymph Node Dissection.** Of the 148,982 patients identified, 42.5% underwent a SLNB (63,358), and 43% (n = 65,551) of those had a metastatic lymph node on final pathology (Figure 1). Overall, CLND was performed in 57% of cases (n = 3,734), but this frequency decreased over time. In 2012, 63% (n = 716) of patients underwent CLND after positive SLNB, decreasing to 48% (n = 719; p ≤ 0.0001) of patients undergoing CLND after positive SLNB in 2016.

Logistic regression analysis was employed to assess the impact of several predictor variables on the likelihood that a patient would or would not undergo CLND after a positive SLNB (Table 3). Patients were significantly more likely to undergo CLND if they were younger than or equal to 55 years of age (OR = 1.454; p ≤ 0.0001), between the ages of 56–65 (OR = 1.127; p = 0.026) or had a Charlson-Deyo Score of 0 (OR = 2.088; p = 0.043). Regarding location, patients were significantly more likely to undergo CLND if the primary tumor was located in the head region (OR = 1.238; p = 0.0002) or on the trunk region (OR = 1.71; p = 0.0002). Patients were more likely to undergo CLND if they were diagnosed with melanoma in 2012 (OR = 1.172; p ≤ 0.0001). Patients were more likely to undergo CLND if they had private insurance (OR = 1.172; p = 0.026). There was no statistical difference between those individuals who had Medicaid and Medicare.
Table 1. Characteristics of 63,358 patients with melanoma who underwent SLNB.

|                      | All Patients Receiving a SLNB (n = 63,358) | All Patients Receiving a SLNB with a Metastatic Lymph Node on SLNB (n = 6,551) | Observation After Positive SLNB (no CLND) (n = 2,817) | CLND After Positive SLNB (n = 3,734) | p value* |
|----------------------|------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------|---------|
| **Gender**           |                                          |                                                                                |                                                  |                                     |         |
| Male                 | 36,870 (58.2%)                          | 3,928 (60.0%)                                                                | 1,663 (59.0%)                                    | 2,265 (60.0%)                       | <0.001  |
| Female               | 26,488 (41.2%)                          | 2,623 (40.0%)                                                                | 1,154 (41.0%)                                    | 1,469 (39.0%)                       | <0.001  |
| **Age**              |                                           |                                                                                |                                                  |                                     |         |
| Median, y (IQR)      | 60.6                                     | 58.7                                                                         | 61.6                                             | 56.4                                | <0.001  |
| <55 y                | 21,798 (34.4%)                          | 2,625 (40.1%)                                                                | 940 (33.4%)                                      | 1,685 (45.1%)                       |         |
| 56 - 75 y            | 15,837 (23.3%)                          | 1,558 (23.8%)                                                                | 641 (22.7%)                                      | 917 (24.6%)                         |         |
| >75 y                | 10,960 (17.3%)                          | 1,019 (15.5%)                                                                | 620 (22.0%)                                      | 399 (10.7%)                         |         |
| **Race**             |                                           |                                                                                |                                                  |                                     | 0.289   |
| White                | 62,115 (98.7%)                          | 6,387 (98.0%)                                                                | 2,746 (98.0%)                                    | 3,641 (98.0%)                       |         |
| Non-White            | 801 (1.3%)                              | 130 (2.0%)                                                                   | 56 (2.0%)                                        | 74 (2.0%)                           |         |
| **Insurance Status** |                                           |                                                                                |                                                  |                                     | <0.001  |
| Not-insured          | 1,281 (2.0%)                            | 185 (2.8%)                                                                   | 67 (2.4%)                                        | 118 (3.2%)                          |         |
| Private              | 33,842 (54.0%)                          | 3,517 (54.2%)                                                                | 1,331 (47.7%)                                    | 2,186 (59.1%)                       |         |
| Medicaid             | 1,903 (3.0%)                            | 312 (4.8%)                                                                   | 121 (4.3%)                                       | 191 (5.2%)                          |         |
| Medicare             | 24,906 (39.7%)                          | 2,395 (36.9%)                                                                | 1,235 (44.3%)                                    | 1,160 (31.4%)                       |         |
| Other Government     | 807 (1.3%)                              | 77 (1.2%)                                                                    | 36 (1.3%)                                        | 41 (1.1%)                           |         |
| **Median Household Income** |                               |                                                                                |                                                  |                                     |         |
| >$63,000             | 25,830 (40.1%)                          | 2,374 (36.3%)                                                                | 1,067 (38.0%)                                    | 1,307 (35.0%)                       | <0.001  |
| $48,000 - $62,000    | 17,992 (28.5%)                          | 1,963 (30.0%)                                                                | 814 (28.9%)                                      | 1,149 (30.8%)                       | <0.001  |
| $38,000 - $47,999    | 12,940 (20.5%)                          | 1,456 (22.2%)                                                                | 600 (21.3%)                                      | 856 (23.0%)                         | <0.001  |
| <$38,000             | 6,488 (10.3%)                           | 750 (11.5%)                                                                   | 333 (11.8%)                                      | 417 (11.2%)                         | 0.001   |
| **Education (% without a HS diploma)** |                                           |                                                                                |                                                  |                                     | <0.001  |
| <7%                  | 21,204 (33.5%)                          | 1,994 (30.5%)                                                                | 876 (31.1%)                                      | 1,118 (30.0%)                       |         |
| 7% - 12.9%           | 22,764 (33.4%)                          | 2,433 (37.2%)                                                                | 1,015 (36.1%)                                    | 1,418 (38.0%)                       | <0.001  |
| 13% - 20.9%          | 13,457 (21.3%)                          | 1,417 (22.5%)                                                                | 614 (21.2%)                                      | 857 (23.0%)                         | <0.001  |
| >21%                 | 5,858 (9.3%)                            | 647 (4.9%)                                                                   | 310 (11.0%)                                      | 337 (9.0%)                          | 0.004   |
| **Charlson-Deyo Score** |                                           |                                                                                |                                                  |                                     |         |
| 0                    | 53,136 (83.9%)                          | 5,362 (81.8%)                                                                | 2,250 (79.9%)                                    | 3,112 (83.3%)                       | <0.001  |
| 1                    | 8,027 (12.7%)                           | 913 (13.9%)                                                                   | 415 (14.7%)                                      | 498 (13.3%)                         | 0.001   |
| 2                    | 1,573 (2.5%)                            | 185 (2.8%)                                                                   | 102 (3.6%)                                       | 83 (2.2%)                           | 0.112   |
| >3                   | 622 (0.9%)                              | 91 (1.4%)                                                                    | 50 (1.8%)                                        | 41 (1.1%)                           | 0.239   |
| **Year of Diagnosis**|                                           |                                                                                |                                                  |                                     |         |
| 2012                 | 11,316 (17.7%)                          | 1,133 (17.3%)                                                                | 417 (14.8%)                                      | 716 (19.2%)                         | 0.001   |
| 2013                 | 12,048 (19.0%)                          | 1,224 (18.7%)                                                                | 498 (17.7%)                                      | 726 (19.4%)                         | <0.001  |
| 2014                 | 12,902 (20.4%)                          | 1,330 (20.3%)                                                                | 545 (19.3%)                                      | 785 (21.0%)                         | <0.001  |
| 2015                 | 13,437 (21.2%)                          | 1,363 (20.8%)                                                                | 575 (20.4%)                                      | 788 (21.1%)                         | <0.001  |
| 2016                 | 13,635 (21.5%)                          | 1,501 (22.9%)                                                                | 782 (27.8%)                                      | 719 (19.3%)                         | <0.001  |
Table 1. Characteristics of 63,358 patients with melanoma who underwent SLNB, continued.

| Tumor Characteristic | All Patients Receiving a SLNB (n = 63,358) | All Patients Receiving a SLNB with a Metastatic Lymph Node on SLNB (n = 6,551) | Observation After Positive SLNB (no CLND) (n = 2,817) | CLND After Positive SLNB (n = 3,734) | p value* |
|----------------------|------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------|----------|
| Breslow Thickness    | <0.001                                   |                                                                                  |                                                     |                                  |          |
| Median, mm (IQR)     | 2.02                                     | 3.12                                                                            | 3.05                                                | 3.17                                            |          |
| >1.00mm              | 21,621 (34.4%)                          | 850 (13.1%)                                                                    | 382 (33.7%)                                         | 468 (12.6%)                                    |          |
| 1.01 - 2.00mm        | 22,283 (35.5%)                          | 1,956 (30.1%)                                                                  | 854 (30.6%)                                         | 1,102 (29.7%)                                  |          |
| 2.01 - 4.00mm        | 11,841 (18.9%)                          | 2,044 (31.5%)                                                                  | 875 (31.4%)                                         | 1,169 (31.5%)                                  |          |
| >4.01mm              | 7,039 (11.2%)                           | 1,645 (25.3%)                                                                  | 679 (24.3%)                                         | 966 (26.1%)                                    |          |
| Ulceration           | <0.001                                   |                                                                                  |                                                     |                                  |          |
| Present              | 14,946 (24.0%)                          | 2,750 (42.4%)                                                                  | 1,167 (41.8%)                                       | 1,583 (42.8%)                                  | <0.001   |
| Absent               | 47,456 (76.0%)                          | 3,742 (57.6%)                                                                  | 1,624 (58.2%)                                       | 2,118 (57.2%)                                  | <0.001   |
| Location             | <0.001                                   |                                                                                  |                                                     |                                  |          |
| Head/Ear/Lip/Neck    | 12,148 (19.2%)                          | 949 (14.4%)                                                                    | 378 (13.4%)                                         | 571 (15.3%)                                    |          |
| Trunk                | 20,077 (31.7%)                          | 2,448 (37.4%)                                                                  | 921 (32.7%)                                         | 1,527 (40.1%)                                  |          |
| Upper Extremity       | 18,347 (29.0%)                          | 1,452 (22.2%)                                                                  | 613 (21.8%)                                         | 839 (22.5%)                                    |          |
| Lower Extremity       | 12,786 (20.1%)                          | 1,702 (26.0%)                                                                  | 905 (32.1%)                                         | 797 (21.3%)                                    |          |

*Missing data for race (n = 442), insurance status (n = 619), median household income (n = 588), education (n = 75), Breslow Thickness (n = 574), Ulceration (n = 956)

Table 2. Factors associated with CLND (compared with observation).

| Predictor                   | p value | Odds Ratio |
|-----------------------------|---------|------------|
| Sex                         |         |            |
| Male (Ref)                  |         | (Ref)      |
| Female                      | 0.993   | 1.00       |
| Age                         |         |            |
| >75 (Ref)                   |         | (Ref)      |
| =55                         | <0.001  | 0.687      |
| 56 - 65                     | 0.023   | 0.886      |
| 66 - 74                     | 0.137   | 0.919      |
| Race                        |         |            |
| White (Ref)                 |         | (Ref)      |
| Non-White                   | 0.507   | 0.939      |
| Insurance Status            |         |            |
| Other Government (Ref)      |         | (Ref)      |
| Not-insured                 | 0.837   | 0.972      |
| Private                     | 0.024   | 0.853      |
| Medicaid                    | 0.5756  | 0.938      |
| Medicare                    | 0.500   | 1.060      |
| Median Household Income     |         |            |
| >$63,000 (Ref)              |         | (Ref)      |
| <$38,000                    | 0.235   | 0.919      |
| $38,000 - $47,999           | 0.410   | 0.929      |
| $48,000 - $62,000           | 0.868   | 0.992      |
Table 2. Factors associated with CLND (compared with observation). continued.

| Predictor                   | p value | Odds Ratio |
|-----------------------------|---------|------------|
| Education (% without a HS diploma) |         |            |
| <7%                         | (Ref)   | (Ref)      |
| >21%                        | <0.001  | 1.301      |
| 13% - 20%                   | 0.415   | 0.958      |
| 7% - 12.9%                  | 0.005   | 0.881      |
| Charleson Deyo Score        |         |            |
| 3                           | (Ref)   | (Ref)      |
| 0                           | 0.043   | 0.859      |
| 1                           | 0.086   | 0.862      |
| 2                           | 0.246   | 1.164      |
| Year of Diagnosis           |         |            |
| 2016                        | (Ref)   | (Ref)      |
| 2012                        | <.001   | 0.794      |
| 2013                        | 0.123   | 0.92       |
| 2014                        | 0.119   | 0.922      |
| 2015                        | 0.863   | 1.01       |
| Breslow Thickness           |         |            |
| >4.01 mm                    | (Ref)   | (Ref)      |
| <1.00 mm                    | 0.017   | 1.153      |
| 1.01 - 2.00mm               | 0.388   | 1.04       |
| 2.01 - 4.00mm               | 0.672   | 0.982      |
| Ulceration                  |         |            |
| Present                     | (Ref)   | (Ref)      |
| Absent                      | 0.081   | 1.052      |
| Primary Site                |         |            |
| Lower Extremity             | (Ref)   | (Ref)      |
| Head/Ear/Lip/Neck           | <.001   | 0.807      |
| Trunk                       | <.001   | 0.853      |
| Upper Extremity             | 0.081   | 0.919      |

Figure 1. Flowchart of inclusion and exclusion criteria.
Table 3. Factors associated with undergoing CLND.

| Predictor                  | β   | Wald χ² | p     | Odds Ratio |
|----------------------------|-----|---------|-------|------------|
| **Sex**                    |     |         |       |            |
| Male (Ref)                 | (Ref) | (Ref)   | (Ref) | (Ref)      |
| Female                     | 0.001 | 0.002   | 0.968 | 1.001      |
| **Age**                    |     |         |       |            |
| > 75 (Ref)                 | (Ref) | (Ref)   | (Ref) | (Ref)      |
| ≤ 55                       | 0.374 | 43.16   | < 0.0001 | 1.454     |
| 56 - 65                    | 0.119 | 4.974   | 0.026 | 1.127      |
| 66 - 74                    | 0.085 | 2.227   | 0.136 | 1.089      |
| **Race**                   |     |         |       |            |
| White (Ref)                | (Ref) | (Ref)   | (Ref) | (Ref)      |
| Non-White                  | 0.061 | 0.462   | 0.519 | 1.063      |
| **Insurance Status**       |     |         |       |            |
| Other Government (Ref)     | (Ref) | (Ref)   | (Ref) | (Ref)      |
| Not-insured                | 0.284 | 0.041   | 0.839 | 1.03       |
| Private                    | 0.159 | 4.939   | 0.026 | 1.172      |
| Medicaid                   | 0.067 | 0.339   | 0.561 | 1.067      |
| Medicare                   | -0.060 | 0.480   | 0.488 | 0.941      |
| **Median Household Income**|     |         |       |            |
| ≥ $63,000 (Ref)            | (Ref) | (Ref)   | (Ref) | (Ref)      |
| < $38,000                  | 0.085 | 1.401   | 0.236 | 1.088      |
| $38,000 - $47,999          | 0.042 | 0.683   | 0.408 | 1.043      |
| $48,000 - $62,000          | 0.007 | 0.026   | 0.872 | 1.008      |
| **Education (% without a HS diploma)** |     |         |       |            |
| < 7% (Ref)                 | (Ref) | (Ref)   | (Ref) | (Ref)      |
| > 21%                      | -0.264 | 12.306 | 0.0005 | 0.768     |
| 13% - 20.9%                | 0.042 | 0.065   | 0.419 | 1.043      |
| 7% - 12.9%                 | 0.127 | 7.834   | 0.005 | 1.136      |
| **Charleston Deyo Score**  |     |         |       |            |
| 3 (Ref)                    | (Ref) | (Ref)   | (Ref) | (Ref)      |
| 0                          | 0.152 | 4.067   | 0.043 | 1.164      |
| 1                          | 0.149 | 2.071   | 0.084 | 1.161      |
| 2                          | -0.152 | 1.352   | 0.244 | 0.859      |
| **Year of Diagnosis**      |     |         |       |            |
| 2016 (Ref)                 | (Ref) | (Ref)   | (Ref) | (Ref)      |
| 2012                       | 0.231 | 16.685  | < 0.0001 | 1.259     |
| 2013                       | 0.082 | 2.312   | 0.128 | 1.086      |
| 2014                       | 0.082 | 2.426   | 0.119 | 1.085      |
| 2015                       | -0.008 | 0.002   | 0.867 | 0.991      |
| **Breslow Thickness**      |     |         |       |            |
| ≥ 4.01 mm (Ref)            | (Ref) | (Ref)   | (Ref) | (Ref)      |
| < 1.00 mm                  | -0.142 | 5.682   | 0.017 | 0.867      |
| 1.01 - 2.00 mm             | -0.039 | 0.744   | 0.388 | 0.962      |
| 2.01 - 4.00 mm             | 0.018 | 0.179   | 1.019 | 0.982      |
CLND has been the standard of care for clinically node-negative patients with SLN positive melanoma since the early 1990s. However, there has been a growing trend in favor of omitting CLND for melanoma patients with a positive SLNB. Given that more than 80% of sentinel lymph node-positive patients have disease limited to the sentinel node, SLNB is thought to have both diagnostic and therapeutic value, potentially eliminating the need for a further, more extensive surgery.

The first objective of this study was to examine the national trends and practice patterns regarding the utilization of CLND in patients after a positive SLNB. From 2012 to 2016, 57% of patients underwent a CLND following a positive SLNB. Patient age (≤ 55 years of age, and between 55 and 65 years of age), tumor location (head/neck region and trunk), year of diagnosis (2012), and total number of comorbidities (Charlson-Deyo Score = 0) were significantly associated with patients electing to undergo a CLND after a positive SLNB.

Two landmark clinical trials, DeCOG-SLT and MSLT-II, were conducted to determine what, if any, therapeutic role CLND had in the treatment of melanoma patients with lymph node metastases. These trials demonstrated that CLND provided no melanoma-specific survival advantage compared to observation following a positive SLNB, suggesting that SLNB in concordance with observation may be sufficient for a subset of patients. As evidence grows that consensus on an optimal model that could be applied in clinical practice.

The second objective of our study was to examine factors associated with undergoing CLND. Our research found that patients were more likely to undergo a CLND if they were younger (< 65 years), had a primary tumor on the trunk or head/neck, had no comorbidities, or underwent primary resection in 2012. Previous studies have identified multiple factors associated with undergoing CLND including age, tumor location, and Breslow thickness. One study suggested that patients were more likely to forgo a CLND if they were older (> 55 years), had multiple comorbidities, had a lower extremity primary tumor location, or underwent primary resection in 2015. Another study found a lower likelihood of undergoing CLND in patients with a positive SLNB if the patients were older (> 75 years), had a primary tumor location.
on the lower extremity and Breslow thickness ≤ 1.00 mm, CLND is avoided in older patients due to the high postoperative risks. The finding that patients were more likely to undergo CLND if the primary tumor was on the trunk or head/neck likely reflects the high complication rate following inguinal node dissection and a tendency to avoid those dissections. Inguinal node dissections are associated with more extended hospital stays, increased wound infection, and delayed wound healing. Finally, though we described the alternative to surgery to be observation, we did not have documentation of the observation strategy implemented for each patient. In fact, the alternative to surgery may have been, for at least some patients, no further evaluation of the concerning lymph node basin.

In the future, it will be essential to continue to monitor the change in national practice patterns concerning the utilization of CLND, in particular, that patients with minimal tumor burden are offered the choice of nodal observation via ultrasound (active surveillance) versus CLND. Additionally, the utilization of CLND should be monitored in patients with more significant tumor burden who are considered a “high risk” subgroup.

CONCLUSIONS

The utilization of CLND among patients with microscopic nodal melanoma was significantly lower in 2016 compared to 2012. Younger age, lack of comorbidities, and primary tumor location on the trunk or head/neck were associated with higher utilization of CLND.

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