Journal of Cancer Therapy, 2015, 6, 245-250
Published Online March 2015 in SciRes. http://www.scirp.org/journal/jct
http://dx.doi.org/10.4236/jct.2015.63027

Scientific Research Publishing

The Pattern and Cost of Palliative Surgeries in Patients with Metastatic Melanoma

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Received 2 February 2015; accepted 5 March 2015; published 9 March 2015

Abstract

Objective: To investigate the pattern of palliative surgeries and associated costs in patients with metastatic melanoma in the USA. Methods: This was a retrospective claims-based study of patients identified using administrative claims from MarketScan® databases among patients with metastatic melanoma diagnosed between 2005 and 2011. Patient characteristics, patterns and cost of surgery, and length of hospital stay were evaluated. Results: Of the 2399 patients identified, 888 (37.0%) underwent at least one surgical procedure either in the outpatient or inpatient setting. The subgroup of patients who underwent surgery included significantly more patients with distant skin metastases compared to the subgroup who did not receive surgery; whereas significantly more patients in the non-surgery group had brain or bone metastases. Surgery performed in the outpatient setting was predominantly on the skin, whereas surgery on the brain was generally performed in the inpatient setting. The mean cost of the surgical procedures performed in the outpatient setting was $3393 (median: $1419) per procedure, which varied according to the location of the metastasis. For surgical procedures that were performed in the inpatient setting, the mean length of stay in hospital due to surgery was 4.4 (± 5.1) days, at a mean cost of $37,649 (median: $28,067) per hospitalization. Conclusions: Surgery is prevalent and costly in patients with metastatic melanoma.

Keywords

Metastatic Melanoma, Surgery Cost, Healthcare Costs, Claims Analysis

1. Introduction

Metastatic melanoma (MM), defined as melanoma that has spread to distant sites such as the skin, subcutaneous

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How to cite this paper: Zhao, Z.Y., Wang, S. and Barber, B.L. (2015) The Pattern and Cost of Palliative Surgeries in Patients with Metastatic Melanoma. *Journal of Cancer Therapy*, **6**, 245-250. http://dx.doi.org/10.4236/jct.2015.63027

tissue, distant lymph nodes, lung or other visceral organs [1] [2], is generally associated with a poor prognosis, with a median overall survival of 6 - 10 months, and a 5-year survival of 5% - 10%, depending on the location of the metastasis [3]-[5]. Surgical intervention for MM is rarely curative since the majority of patients with distant metastases have widespread micrometastatic disease and circulating tumor cells. Nevertheless, palliative surgery for distant metastases can be considered in patients where some benefits may be expected [6], such as to reduce tumor burden before the use of adjuvant immunotherapies [7]. Few studies have examined the patterns and cost of surgical procedures in this patient population.

This study used commercial insurance claims databases to investigate the pattern of palliative surgical procedures and associated costs in patients with MM in the USA.

2. Patients and Methods

2.1. Data Source

We analyzed the Truven Health Analytics MarketScan® Commercial Claims and Encounter Database and the Medicare Supplemental and Coordination of Benefits database, between 1 January 2005 and 31 March 2011. The MarketScan databases contain fully adjudicated patient-level medical and pharmacy claims for 34.7 million commercially-insured lives in the working population and 4.1 million lives in the Medicare supplemental population in 2011.

The databases contain a full continuum of care under a variety of plan types across all settings (physician office visits, emergency room visits, inpatient hospital stays, outpatient visits, and outpatient pharmacy claims). Patients enrolled in the databases show a similar overall age distribution to the nationally representative population in Medical Expenditure Panel Survey.

2.2. Study Population

Patients were included in the study if they had ≥2 outpatient (or ≥1 inpatient) melanoma diagnoses (ICD-9-CM: 172.xx, V10.82) and ≥1 outpatient or inpatient diagnoses for metastasis (ICD-9-CM: 197.xx, 198.xx). For patients identified based on outpatient diagnoses, the two outpatient diagnoses for melanoma needed to be 30 days apart. The first metastasis date was to be ≤30 days before, or any time after, the first melanoma diagnosis. The index date was the first date of metastasis diagnosis.

Patients were excluded from the study if they had other primary malignant tumors to the melanoma diagnosis, were younger than 18 years old at the index date, or had a pre-index continuous enrolment period of less than 6 months.

2.3. Study Assessments

Patient details were followed from the index date to death, termination of enrollment, or to the end of database availability (31 March 2011), whichever occurred first. Surgical procedures that were likely to be related to melanoma treatment and had been performed on skin, brain, liver, lung, lymph nodes or soft tissue were included in this study. Exploratory or diagnostic procedures were excluded.

Procedures performed in the outpatient setting as well as inpatient surgical procedures on the brain (craniectomy, surgery of the skull base, craniotomy, incision, excision), liver (incision, excision, repair, hepatectomy), lung (incision, excision, thoracoscopic excision, removal, lobectomy), lymph nodes (incision, excision), skin (shaving, excision, removal, destruction, repair, Mohs surgery, local excision or destruction), and soft tissue (tumor excision) were included in the study.

Surgical procedures in the outpatient setting were identified using the Current Procedural Terminology codes. Within the inpatient setting, hospitalizations where the surgery of interest was the primary reason for hospitalization were included in the study. Surgical procedures performed during such hospitalizations were identified using the primary ICD-9-CM procedure codes. The costs of surgical procedures were estimated using data including the third-party payer payment and individual patient out-of-pocket payment. The costs were adjusted to 2011 values using the annual medical care component of the Consumer Price Index.

2.4. Statistical Analysis

Clinical and demographic data were compared between patients who received surgical procedures and those

who did not. The t-test was conducted for continuous variables, chi-squared test was performed for categorical variables and nonparametric Wilcoxon signed-rank sum test was used for median test. Costs of surgical procedures were calculated as mean and median values. The number of surgical procedures on each location as well as on all locations was calculated.

3. Results

3.1. Patient Characteristics

A total of 2399 patients with MM were identified within this study. The mean age was 60.2 (±14.4) years, with 21.3% aged <50 years and 65.5% aged <65 years. Patients were predominantly male (62.7%).

As expected, the most common sites of metastases were distant skin (18.3%), lung (14.3%) and the brain (12.4%), with 9.5% of patients studied having metastases at multiple sites. A summary of the patient demographic characteristics is presented in **Table 1**.

3.2. Pattern of Surgery in Patients with MM

Of the 2399 patients identified, 888 (37.0%) underwent at least one surgical procedure either in the outpatient or inpatient setting.

Table 1. Patient demographic and clinical characteristics.

	Total number of patients (N = 2399)	No surgery (N = 1511)	Received surgery (N = 888)
Age at Index, mean (SD)*	60.2 (14.4)	60.9 (14.3)	59.0 (14.5)
18 - 30, %	2.4	2.2	2.7
30 - 50, %	18.9	17.8	21.0
50 - 65, %	44.2	43.2	45.8
≥65, %*	34.5	36.8	30.5
Female, %	37.3	36.3	39.1
Health Insurance Plan			
Comprehensive	18.3	18.5	17.9
HMO	13.4	14.2	12.2
POS	6.1	6.4	5.5
PPO	54.2	53.5	55.5
Other plans	8.0	7.4	8.9
Metastatic site at Index, %			
Lung	14.3	15.2	12.8
Brain*	12.4	14.8	8.2
Distant skin*	18.3	12.7	27.7
Bone*	7.2	8.5	5.0
Liver*	6.7	8.0	4.5
Multiple sites*	9.5	11.5	6.1
Length of follow-up, mean days (SD)*	376.5 (426.7)	275.9 (333.4)	547.8 (506.3)
Length of follow-up, median days*	224	161	383.5

*Indicates statistical significance at 5% level.

3.3. Comparison with Patients Who Did Not Receive Surgery

Patients who underwent surgery were generally slightly younger than those who did not, with a smaller proportion of patients aged ≥65 years (30.5% vs 36.8%; $p < 0.05$). In addition, the subgroup who underwent surgery included significantly more patients with distant skin metastases compared to the subgroup who did not receive surgery (12.7% and 27.7%, respectively, $p < 0.05$). As expected, significantly more patients in the non-surgery group had brain metastases (14.8% vs 8.2%, $p < 0.05$) and multiple metastases (11.5% vs 6.1%, $p < 0.05$) compared to those in the surgery group. A significantly longer mean period of follow-up was also observed in patients undergoing surgery compared to those who did not (548 vs 276 days, $p < 0.05$). These results are summarized in **Table 1**.

3.4. Inpatient and Outpatient Procedures

Of the 888 patients undergoing surgical procedures, 758 patients received a total of 1395 surgical procedures in the outpatient setting (**Table 2**), which were performed predominantly on the skin (n = 1181), followed by surgical procedures on the soft tissues (n = 108) and lung (n = 75).

In the inpatient setting, 207 patients were hospitalized for a total of 231 surgical procedures, the majority of whom underwent surgical procedures on the brain (n = 88), lung (n = 82) and lymph nodes (n = 43). A summary of inpatient surgical procedures in patients with MM is presented in **Table 2**.

3.5. Cost of Surgery in Patients with MM

The mean cost of the surgical procedures performed in the outpatient setting was $3393 (median: $1419) per procedure, which varied according to the location of the metastasis. The majority (1181/1395) of surgical procedures in the outpatient setting were performed on skin, at a mean cost of $3096 (median: $1223) per procedure (**Table 2**).

For surgical procedures that were performed within the inpatient setting, the overall mean length of stay in hospital due to surgery was 4.4 (±5.1) days. Mean length of hospital stay was greatest for procedures performed

Table 2. Surgical procedures and costs in the outpatient and inpatient settings.

Location of surgical procedure	Number of surgical procedures*	Mean cost (US dollars)	Median cost (US dollars)	Standard deviation
Outpatient procedures				
Brain	15	12,589	5301	16,940
Liver	4	7378	993	12,889
Lung	75	2617	1211	3920
Lymph nodes	12	11,169	10,985	6880
Skin	1181	3096	1223	4635
Soft tissue	108	4887	3757	3732
All locations	1395	3393	1419	5044
Inpatient procedures				
Brain	88	52,511	45,109	40,199
Liver	11	39,609	30,293	29,944
Lung	82	27,545	25,215	17,300
Lymph nodes	43	22,499	16,191	19,457
Skin	7	59,150	15,134	110,167
All locations	231	37,649	28,067	36,325

*Or number of hospitalizations for inpatient procedures.

on the skin (8.4 ± 11.3 days, n = 7), followed by brain (6.4 ± 6.7 days, n = 88), liver (5.2 ± 3.4 days, n = 11), lung (3.0 ± 2.1 days, n = 82) and lymph nodes (2.3 ± 1.7 days, n = 43). Median lengths of hospital stays were 3.0, 4.0, 5.0, 2.5 and 2.0 days, respectively.

The overall mean cost of hospitalizations due to surgical procedures was $37,649 (median: $28,067) per hospitalization. The greatest proportion of the overall mean cost of hospitalization due to surgery was associated with procedures on the brain ($52,511), liver ($39,609) and skin metastases ($59,150). These procedures were also associated with the longest stays in hospital.

4. Discussion

Data from this study suggest that palliative surgery is prevalent with over one third of the patients studied undergoing at least one surgical procedure in either the inpatient or outpatient setting. As expected, the majority of surgical procedures conducted within the inpatient setting were performed on brain, lung and lymph nodes, and most outpatient surgical interventions involved the skin.

The findings of the study also showed that surgery in patients with MM was costly. There were a total of 1395 surgical procedures performed in the outpatient setting, with a mean cost of $3393 per procedure, and 231 hospitalizations due to surgery with a mean cost of $37,649 per hospitalization. For patients who received surgery in the inpatient setting, the most expensive procedures were those that were associated with the longest stay in hospital. In particular, among patients who had surgery, patients received on average 1.84 and 1.12 surgical procedures in outpatient setting and inpatient setting, respectively, which represents a mean cost of $6243 per patient in the outpatient setting and $42,167 per patient in the inpatient setting.

Patients included in this study had metastatic melanomas; surgical interventions in this patient population were predominantly palliative where with such surgeries no overall survival benefit has been demonstrated [1]. Aside from the economic burden on payers and patients, surgeries may cause significant body or facial disfigurement, which is associated with a reduction in patients' quality of life and which may adversely affect all three domains of functioning (mental, physical, and sexual) [1].

There were a number of limitations associated with this study. Data were taken from a commercial insurance claims database, and so may not be wholly representative of the US MM patient population as a whole. The purpose of the surgery was not recorded in the databases, and therefore we did not include the reasons for surgery in our analysis. In most cases surgery was likely to be palliative rather than providing a survival benefit. Furthermore, this study did not evaluate all surgical procedures carried out, for example only those that were most likely related to melanoma treatment rather than diagnosis were examined; consequently, the prevalence of surgical procedures in patients with MM may be underestimated. Additionally, in the outpatient setting, the sample size was small for surgical procedures on the liver, lymph nodes and brain, and in the inpatient setting on skin and liver. Therefore, the cost estimates derived from these small samples should be interpreted with caution.

This study shows that surgical interventions are prevalent, representing a major component of treatment options in patients with MM. This study also demonstrates that surgical interventions are costly, in particular those that are performed in the inpatient setting.

Acknowledgements

This study was funded by Amgen Inc. Zhongyun Zhao and Beth Barber are currently employed, and Song Wang was previously employed by Amgen Inc. Medical writing assistance was provided by apothecom scopemedical ltd, funded by Amgen Inc.

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