A Retrospective Study on the Effects of Coal Tar on Melanoma Incidence

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Introduction

- Melanoma is an aggressive skin cancer arising from melanocytes, with steadily increasing incidence rates in the United States[1]. It accounts for the majority of skin cancer-related deaths, underscoring the need for a comprehensive understanding of its risk factors. Melanoma development is influenced by a range of genetic and environmental factors, with ultraviolet radiation exposure well-established as a major environmental contributor [4]. However, other potentially carcinogenic exposures, such as coal tar, have received comparatively less attention in the context of melanoma risk.
- Coal tar has a longstanding history in dermatologic treatments for conditions including psoriasis, atopic dermatitis, and seborrheic dermatitis due to its anti-inflammatory properties[3]. Despite these therapeutic applications, coal tar can pose exposure risks through inhalation, ingestion, and dermal absorption, particularly at high concentrations. Previous research has linked chronic, high-level coal tar exposure to an increased risk of skin cancer[5], yet the association with melanoma specifically remains unclear.
- This study explored the potential correlation between coal tar exposure through dermatologic applications and the risk of developing melanoma.

Figure 1. Coal tar bar soap

Methods

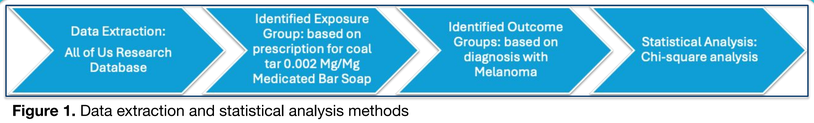

Figure 1. Data extraction and statistical analysis methods

- Study Design: A retrospective study was conducted using the *All of Us* database, a secure national medical database containing medical records from nearly one million patients. This comprehensive dataset provided diverse patient information, enhancing the robustness and generalizability of the analysis.
- Data Collection: Data was extracted and analyzed for individuals with a documented history of either: coal tar use (0.002 mg/mg Medicated Bar Soap) or melanoma diagnosis.
- Exclusion Criteria:
  - Patients with a diagnosis of second- or third-degree sunburns, a well-established risk factor for melanoma, were excluded from the study.
  - For individuals exposed to both coal tar and melanoma, only participants diagnosed with melanoma after coal tar exposure were included in the analysis.
- Statistical Analysis: A chi-square test was performed to evaluate the association between dermatologic coal tar exposure and melanoma incidence within the selected cohort. The chi-square statistic provided evidence of whether the observed association deviated significantly from what would be expected by chance.

Results

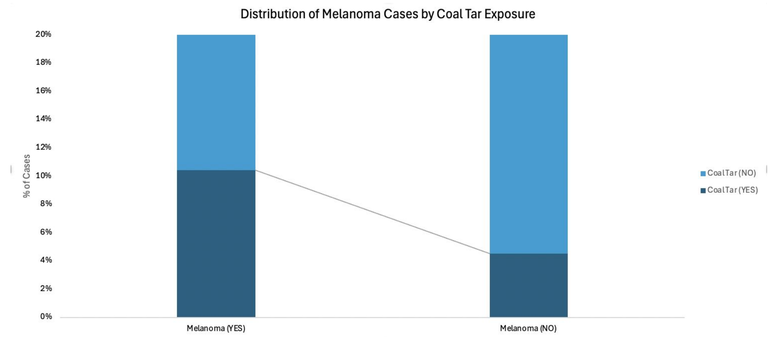

Figure 2. Distribution of Melanoma by Coal Tar Exposure. 13,209 patients were identified who were prescribed coal tar soap, of whom 247 developed melanoma, compared to 273,803 patients who had never been exposed to coal tar. Of these patients, 2,122 have been diagnosed with melanoma. Patients with second or third-degree sunburns were excluded from both groups. Percent of cases were adjusted to a 20% max for better visualization of data

- Statistical Significance: A statistically significant association was observed between coal tar prescription and melanoma incidence, with a p-value of less than 0.05 ($p < 0.0001$). This indicates that the observed association is unlikely to be due to chance.
- Chi-Square Analysis: The chi-square test revealed a strong deviation from the null hypothesis, with a chi-square statistic of 186.81. This robust association between coal tar exposure and melanoma incidence suggests a meaningful relationship.
- Odds Ratio: Individuals prescribed coal tar were found to be 2.46 times more likely to develop melanoma compared to those who were not exposed (Odds Ratio: 2.46).
- Incidence Rates:
  - Among individuals exposed to coal tar, 1.9% developed melanoma.
  - In contrast, only 0.78% of unexposed individuals developed melanoma.
- Absolute Risk Difference:
  - The absolute risk difference between exposed and unexposed groups was 1.12%, highlighting the increased melanoma risk associated with coal tar exposure.
- Number Needed to Harm (NNH):
  - The number needed to harm (NNH) was calculated as 89, meaning that for every 89 individuals exposed to coal tar, one additional case of melanoma would be expected compared to unexposed individuals.

Conclusions

- The results from this study provide evidence of a correlation between coal tar exposure through dermatological application and an increased risk of developing melanoma. The findings of this study further support the hypothesis that melanoma of the skin is a multifactorial condition and is influenced by a combination factors.
- This finding holds significance as dermatological application of coal tar has been indicated for treating skin conditions such as eczema and psoriasis[2]. The use of coal tar as treatment for other non-cancerous skin conditions could potentially increase the likelihood of those patients developing Melanoma with chronic use
- With the results of our investigation of the link between coal tar and melanoma incidence , we hope to provide new insights into melanoma risk factors, help guide safer dermatologic practices, and inform future public health recommendations.

Future Directions

- Further investigation to determine at what frequency and duration of coal tar usage will lead to increased melanoma risk.
- Further exploring the relationship between coal tar and melanoma risk by implementing other platforms, outside of the *All of Us,* into the statistical analysis.
- Investigate potentially harmful cellular mechanisms and components of coal tar.

References

Acknowledgements

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