A single sunburn influences the immunological component of human skin for up to 14 days

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INTRODUCTION

Sunburn is prevalent, and while the clinically apparent effects disappear relatively quickly, repeated episodes have longer term consequences including skin cancer. Pro-inflammatory eicosanoid expression and leukocytic infiltration characterise the peak of the sunburn response¹; however, little is known of these processes during the resolution phase.

Therefore, in human skin, we examined the changes in eicosanoid expression and leukocytic infiltration up to 14 days post acute sunburn.

METHODS

- Ethical approval was granted by the North Manchester NHS Research Ethics Committee (ref 11/NW/0567).
- Exclusion criteria were sunbed use and recent sunbathing, pre-existing skin conditions including skin cancer, use of anti-inflammatory medication and omega-3 supplements.
- 13 healthy white Caucasian adults were recruited (20-58 years, 5M/8F, phototype I-III).
- Photoprotected buttock skin was exposed to a single 3x MED of broadband ultraviolet radiation (UVR; Waldman UV6; 280-400nm) at multiple sites and changes in skin erythema were measured over a 14 day period using a spectrophotometer (CM600d, Konica Minolta Sensing Europe).
- Biopsies and suction blister fluid were sampled from unexposed and UVR-exposed skin across the 14 day time-course and analysed by immunohistochemistry (neutrophil elastase, CD4, CD8, CD68, CD1a, COX-2, EP4) and LC-MS/MS (eicosanoids).

RESULTS

1) The erythematous response to UVR is not fully resolved at day 14 post-exposure

A) Hemoglobin (Hb) Index and % resolution of erythema. By day 7 post-UVR, erythema had resolved by 60% and by day 14 had 80% resolved, * $p < 0.05$ compared to unexposed skin. **B) Photograph of skin showing the sunburn response to 3xMED of UVR over the 14 day resolution period.**

2) Epidermal expression of COX-2 peaks at day 1 while PGE₂ receptor EP4 is elevated up to day 10

A) % area expression of skin COX-2 and EP4. *** $p < 0.001$, $p < 0.01$, $p < 0.05$ compared to unexposed skin. **B) Image of COX-2 and C) EP4 expression in skin.**

RESULTS

3) Epidermal pro-inflammatory prostaglandin and hydroxy fatty acid levels peak at day 1 post UVR

4) Macrophage, CD4+ and CD8+ T cell numbers remain elevated up to 14 days and Langerhans cell numbers are depleted for up to 10 days, post-UVR exposure

CONCLUSIONS

- A single exposure to high dose UVR results in a sunburn response that lasts 10 to 14 days in the skin of individuals with phototype I-III.
- This is characterised by ongoing erythema and elevated expression of prostaglandin receptor EP4, which could facilitate maintenance of the erythematous response.
- An inflammatory infiltrate of innate and adaptive immune cells is also sustained up to 14 days, while LC are depleted for 10 days, potentially leaving the skin immunocompromised during this time.
- Further study of the sunburn resolution phase could elucidate the contribution of these inflammatory/immune changes to skin cancer.

REFERENCES

- Rhodes LE et al. The sunburn response in human skin is characterized by sequential eicosanoid profiles that may mediate its early and late phases (2009) FASEB J 23 (11):3947