# The Use of Laser Doppler Imaging (LDI) in Nitric Acid Burns: a Case Report and Literature Review.

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## BACKGROUND

- Early and accurate determination of burn depth plays a major role in clinical, functional and aesthetic outcomes for burns patients.
- Laser Doppler Imaging (LDI) is a NICE validated adjunctive tool to assess thermal burn depth by predicting wound healing potential with >90% accuracy, 2-5 days post-injury.
- However, there is no clear evidence for its use in chemical burns.

## AIMS AND METHODS

- We present a case report of the assessment, management and outcome of an acute nitric acid burn, and our experience using LDI to assess burn depth in this case.
- A comprehensive literature review, using the MEDLINE (PubMed) database to identify animal or clinical studies evaluating the efficacy of LDI in chemical burns was performed. A qualitative synthesis of our findings is presented.

## CASE REVIEW

A 36 year-old male presented with an accidental Nitric Acid Burn. Initial assessment showed an 8% TBSA burn presenting as a well demarcated patch of brown discolouration to bilateral lower legs(**Fig 1**). Initial management was Immediate first aid with water and Diphoterine spray at 2-hours post-injury.

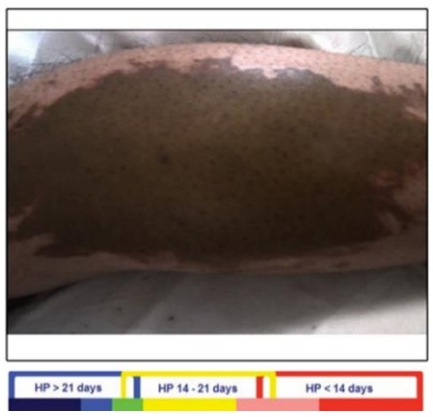
LDI assessment on day 3 suggested poor healing potential of >21 days (**Fig 2**). However, conservative management was opted for based on clinical assessment as the wound eschar appeared thin and more consistent with epithelial staining.

Clinical wound review on Day 6, 11 and 14 showed the eschar progressively lifting to reveal underlying pink re-epithelialising tissue with good capillary refill.

The patient was discharged after pain optimisation. Regular clinical follow-up revealed a severe delay in wound healing (**Fig 3**), with a total wound healing time of > 2 months with significant scarring.

**Figure 1**: Day 1 Post-Injury

**Figure 3**: Day 30 Post-Injury



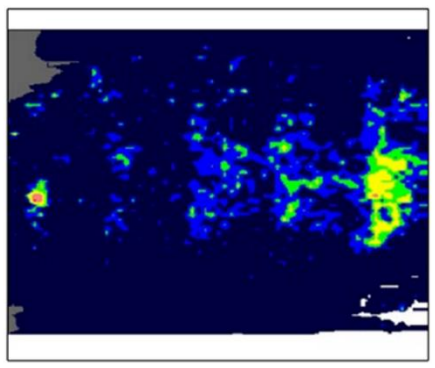



**Figure 2**: LDI Imaging Day 3 Post-Injury

## LITERATURE REVIEW

| | BROWN ET AL (1998) | BRAUE ET AL (2007) |
|---|---|---|
| SUBJECT (SIZE) | White pigs (8) | Female swine (6) |
| CHEMICAL | Sulphur Mustard / Lewsite Vapour | Sulphur Mustard |
| EXPOSURE TIME | 6 hours | 2, 8, 30 and 60 minutes |
| OUTCOME MEASURE | LDI **vs** Histopathology at: 2hr, 4hr, 6hr, 24hr, 3 days and 7 days post-exposure | LDI **vs** Indocyanine Green Fluorescence **vs** Histopathology at: 24hr, 48hr, and 72hr post-exposure |
| RESULTS | <u>Up to 24hr post-injury:</u><br>• Histopathology demonstrated evidence of superficial burns.<br>• LDI showed extensive areas of high flux, peaking at 4 hrs post-injury.<br><br><u>At Day 3 and 7 post-injury:</u><br>• Histopathology evidence of full thickness burns.<br>• LDI images showed extensive areas of low flux, surrounded by areas of high flux. | <u>At 2 and 8 minute exposure sites:</u><br>• Histological evaluation demonstrated evidence of a superficial and intermediate burn, respectively.<br>• LDI imaging for these sites showed levels of high flux.<br><br><u>At 30 and 60 minute exposure sites:</u><br>• Histological evaluation demonstrated deep dermal and full thickness burn, respectively.<br>• LDI and imaging for these sites showed low levels of flux. |
| CONCLUSION | LDI correlates with histological assessment of burn depth. | LDI provided good estimates of lesion depth when compared to histological analysis. |

## CONCLUSION

In both animal studies, LDI results corresponded with histological assessment of chemical burn depth, in accordance with the experiential findings in this case. However, this is insufficient to prove its validity. Clinical trials are required to further assess and define the parameters of LDI use and efficacy in this context.