Introduction: Sulfur mustard burns differ from thermal burns in that healing is indolent and slow. The major site of injury is the basement membrane and the rapidly-proliferating basal epidermal cell. Incomplete debridement at this level is thought to be one cause of indolent healing. Graham et al pioneered laser debridement of mustard-damaged cells. Laser debridement may be impractical for field use or during mass-casualty incidents, where saline or antibiotic-soak debridement is more likely to be used. In this study, we compared laser debridement with two conventional methods in a porcine model of deep partial thickness injury.

Methods: Deep dermal sulfur mustard burns were produced in anesthetized Gottingen minipigs (6 pigs per debridement group, 8 lesions per pig) using 10 μL saturated vapor cap exposure for 90 minutes. Debridement was started 48 hours post-injury and consisted of a single laser debridement; 5 days of 5% aqueous mafenide wet-to-wet dressings; or 7 to 12 days of saline wet-to-wet dressings. Following debridement, wounds were treated with silver sulfadiazine daily for 30 days. Wounds were then assessed by histopathology, silver ion analysis and bioengineering methods. Because of the time required for saline and mafenide debridement, thirty-day assessment of wounds occurred at post-exposure day 32 for laser, day 37 for mafenide and day 39 for saline groups.

Results: All of the sulfur mustard wounds healed well. There were no significant differences between debridement groups for colorimetry or transepidermal water loss (TEWL) measurements. Silver-ion levels in the wounds averaged 22.4 μg/L for the laser group, 11.5 μg/L for the mafenide group and 8.1 μg/L for the saline group. Histopathology was graded on a mustard-specific scale of 1–15 where higher values indicate better healing. Mean histology scores were 13.6 for laser, 13.9 for mafenide and 14.3 for saline. Saline debridement statistically outperformed laser at a 5% level, however the saline group required the longest time for debridement and had 7 more days of healing time compared with laser.

Conclusions: All three debridement methods produced satisfactory wound healing. There were no signs of wound infection in any group and antibiotic wet-to-wet debridement showed no advantage over saline debridement. Laser debridement has the benefit of requiring a single treatment rather than 5 or 7 days of daily dressing changes. In a mass-casualty scenario, this would represent significant savings of resources and nursing time.

Applicability of Research to Practice: Laser debridement is uncommonly used for thermal burns but may represent the method of choice for sulfur mustard burns, as a single laser debridement may replace several days of wet-to-wet dressings.