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96.5 **Using Computer Vision-Based Algorithms Trained on Mobile-Device Camera Images for Monitoring Burn Wound Healing**

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**Introduction:** The appropriate characterization of burn depth and healing is paramount. Unfortunately, the accuracy of approximating thermal injury depth among all physicians is poor. While tools to improve detection accuracy, including laser doppler imaging and laser speckle imaging exist, these technologies are expensive and limited to specialized burn referral centres. They also do not provide an easy means for quantitative, interval tracking of burn healing. Considering these limitations, the application of artificial intelligence has garnered significant interest. We herein present the use of three novel machine learning and computer vision-based algorithms to track burn wound healing.

**Methods:** Convolutional neural network (CNN) models, were trained on 1800 2D color burn images, to classify them into four burn severities. These CNNs were used to develop saliency algorithms that identify the highest “attention” pixels used to recognize burns. Image-based algorithms that count these attention pixels of the CNN, count pixels representing red granulation of burns, and measure burns, were also developed. As proof-of-concept, we tracked the healing of a localized burn on a 25-year-old female patient. The patient suffered a scald on the dorsum of the foot, resulting in a deep partial-thickness burn. Opting out of surgical intervention, the patient visited the hospital over a 6-week period for treatment with non-adhesive dressings and silver nitrate. High-resolution images of the burn, with and without a fiducial marker, were captured with a smartphone camera every 7-days. Images were taken under institutional lighting and used as algorithmic inputs.

**Results:** Data analyses indicate that the healing of the open-wound area was accurately measured in millimetres (+/- 1.7 mm error) using a fiducial marker (18.3 mm diameter). The open-wound area shrank consistently from week 1 to week 6 seen in (Figure 1. a-b). The normalized, 2D colour images, where the “red” pixel value was counted (Figure 1. a-b), confirms the reduction of the red granulation in the wound. The saliency algorithm also measured a percentage reduction in the machine learning model’s total attention pixels over the 6-week period (Figure 1. c-d). This suggests that the model was less discerning of the healing burn wound over time, suggesting burn healing, which was also clinically validated.

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C-351

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97 **Arterial Waveform Variations as Measures of Resuscitation Adequacy in a Porcine Model of Burn Injury**

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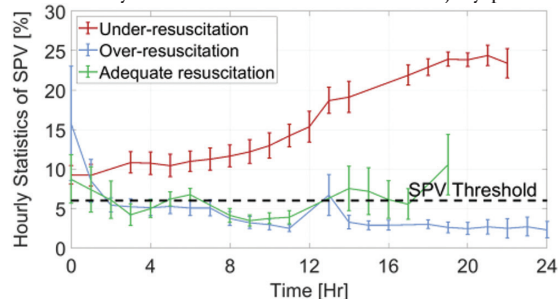
**Introduction:** Optimized fluid resuscitation of burn patients is a clinical care challenge as both under- and over- resuscitation have deleterious consequences. The gold-standard endpoint guiding burn resuscitation is urinary output (UO), which is known to have limited efficacy. We investigated the potential of the dynamic indices of fluid responsiveness derived from arterial blood pressure (BP) waveforms in conveying information about burn resuscitation. In particular, we investigated pulse pressure variation (PPV) and systolic pressure variation (SPV), which have been shown to be valuable in a number of other indications.

**Methods:** We conducted a retrospective analysis of arterial BP waveform data acquired from six anesthetized and mechanically-ventilated pigs (33±5 kg weight and 40% total burned surface area) which were instrumented for hemodynamic monitoring for 24 hours. The animals were either under-, over-, or adequately-resuscitated (guided by a burn resuscitation decision support system), with two animals in each group. PPV and SPV were calculated on an hourly basis. Fluid responsiveness thresholds of 15% and 6% were used respectively for PPV and SPV, as per literature.

**Results:** All of the animals experienced an immediate rise in PPV and SPV following the injury (PPV and SPV start from large values as seen in Fig. 1 and Fig. 2). In the under-resuscitated group, PPV and SPV increased above the threshold, reaching maximum values in the last eight hours (PPV: 49.8±20%, SPV: 24.7±3.6%), indicating severe hypovolemia. In the over-resuscitated group, PPV and SPV decreased below the threshold, reaching their minimum in the last eight hours (PPV: 8.7±3.6%, SPV: 4.1±1.9%), indicating major hypervolemia. In the adequately-resuscitated group,

PPV and SPV maintained closer to the threshold throughout the duration of the experiment, and at the end, PPV was  $15.6 \pm 4.2\%$  and SPV was  $6.2 \pm 2.6\%$ .

**Conclusions:** Our initial results suggest that PPV and SPV may help distinguish under-, adequately-, and over-resuscitated burn patients, and potentially complement UO in the hemodynamic assessment of the burn injury patients.



## 98 Plasma Extracellular Vesicles Released After Severe Burn Injury Modulate Macrophage Function

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**Introduction:** Extracellular microvesicles (MVs) have emerged as key regulators of immune function across multiple diseases and potential biomarkers. Severe burn injury is a devastating trauma with significant immune dysfunction that results in an ~12% mortality rate due to sepsis-induced organ failure, pneumonia, and other infections. Severe burn causes a biphasic immune response: an early (0-72 hrs) hyper-inflammatory state, with release of pro-inflammatory damage-associated molecular pattern molecules (DAMPs), such as HMGB1, and cytokines (e.g.IL-1b), followed by an immunosuppressive state (1-2 weeks post injury), associated with increased susceptibility to life-threatening infections. We have reported that early after severe burn injury HMGB1 and IL-1b are enriched in plasma microvesicles (MVs), suggesting a role for MVs in post-burn immune activation. Here we tested the impact of MVs isolated after burn injury on phenotypic and functional consequences *in vivo* and *in vitro* using adoptive MV transfers.

**Methods:** We then assessed if the cargo of MVs following burn injury in humans could predict length of hospital stay. MVs isolated early from mice that underwent a 20% total body surface area (TBSA) burn injury (burn MVs) caused similar cytokine responses in naïve mice to those seen in burned mice early after injury. Burn MVs transferred to RAW264.7 macrophages caused similar functional (i.e. cytokine secretion) and genetic changes (measured by NanoString™) seen with their associated phase of post-burn immune dysfunction.

**Results:** Burn MVs isolated early (24h) induced MCP-1, IL-12p70 and IFN $\gamma$ , while MVs isolated later (1 and 2 weeks) blunted RAW proinflammatory responses to bacterial endotoxin (LPS). Unbiased LC-MS / MS proteomic analysis of early EVS (< 72 h post-injury) showed similarities in human and mice.

**Conclusions:** In our sample of large burn injury, EV SAA1 and CRP correlated with TBSA injury in both sexes and were correlated with length of hospital stay in women.