Development of a Accessible pH-Monitoring Wound Dressing for Early Detection of Surgical Site Infections

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Purpose: Surgical site infections cause significant morbidity and even mortality. Increase in wound pH has been correlated with infection and may identify infection before clinical symptoms occur. The aim was to create a cost-effective pH-sensing wound dressing that could be used for early surgical site infection by simple visual inspection of a color change. Procedure: Bromothymol blue (BTB) was selected as the pH-indicating dye because it provides a color change (acidic = yellow, alkaline = blue) detectable to the unaided eye. Several variables: hydrogel material and concentration, amount of BTB, addition of BTB before/after solidification, and amount of gauze (used to simulate the wound bed), were tested to find the optimal hydrogel that provided a distinct color change from yellow to blue across a range of pH 5.0-8.0 on all 6 Fitzpatrick skin colors. Results: The optimal hydrogel consisted of 3mL of a 0.67% gelatin solution and 0.25µg BTB added after solidification and showcased the greatest range of B-value from very yellow at pH 5.0 to very blue at pH 8.0 and had a color change that was easily visually detectable and statistically significant (in pH 5.0 compared to pH 7.25 and 8.0) on all 6 Fitzpatrick skin color types. This color differential was visually detectable from 5 minutes of dressing application to 100 hours. Conclusions: This optimal pH-sensing hydrogel dressing was very cost-efficient ($0.40 per dressing). It may provide a method for early detection of wound infection for patients with difficult access to care such as in the developing world.