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Analysis of Physiologic Function of the Skin and Microbiome in Patients with Pressure Injury

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Introduction

- Pressure injury is a common complication localized to the skin or underlying soft tissue caused by pressure or shearing force or friction.
- The differences in skin pH and microbiome have been previously studied between the bedridden older patients and healthy people, but analysis of only pathologic people have not been studied.
- Therefore, in order to understand the pathophysiology of pressure injury, this study aims to confirm the differences in physiologic function of the skin and microbiome according to the severity of pressure injury.

Methods

- **Participants** : Between 2019 and 2022, 30 patients with pressure injury
- **Grade** : 1 to 4, based on National Pressure Injury Advisory Panel (NPIAP)
- **Skin Locations (pH Meter and Skin Swab; Three areas)**
  - Area 1 (Center of the pressure injury, A1)
  - Area 2 (Boundary of the pressure injury, A2)
  - Area 3 (Normal skin at least 20 cm away from the affected area, A3)
- **Measurement**
  - **pH/Ion meter**
    (Compact S220®; METTLER TOLEDO., Korea, Figure 1)
    - Calibration every measurement
    - Average pH value obtained sterilely per site (Area 1, 2, 3; at least 3times)
    - Inspection time : 20-30 seconds per site

Figure 1. pH/Ion meter

  - **The microbiome samples**
    - Skin swab is obtained sterilely per site (Area 1, 2, 3; the most affected)
    - Inspection time : 10 seconds per site (Clockwise direction)
    - Analysis process by laboratory medicine specialist
- **Statistics Analysis**
  - **pH data according to pressure injury grade**
    - RM ANOVA
    - Mutiple pairwise comparisons (Bonferroni correction)
  - **Microbiome distributions according to pressure injury grade**
    - Pearson Chi-square test

Results

1. Percentage According to Severity of Pressure Injury (Table 1)

Table 1. Percentage According to Severity of Pressure Sore

Grade 1	Grade 2	Grade 3	Grade 4	Total
1 (3.3%)	11 (36.7%)	17 (56.7%)	1 (3.3%)	30 (100%)

- Grade 1 and 4 were 1 patient.
- Most patients were Grade 2 and 3.
- Grade 3 was the most common at 56.7%.

2. Differences of Skin pH According to Pressure Injury Grade (Table 2)

Table 2. The pH Analysis Results

Variables	A1	A2	A3	Overall Significant Difference	A1 – A2	A1 – A3	A2 – A3
pH	7.40±0.68	6.94±0.57	6.43±0.44	<0.001[1)]	<0.001[2)]	<0.001[2)]	<0.001[2)]

1) RM ANOVA, 2) Bonferroni Correction

- The pH analysis
  - 7.40±0.68 in A1
  - 6.94±0.57 in A2
  - 6.43±0.44 in A3
  - Significant differences between all groups *(p<0.001)*
- Post hoc tests were Significant differences between A1 and A2, A1 and A3, A2 and A3.

3-1. Microbiome Analysis in A1 (Figure 2) *(P<0.031)*

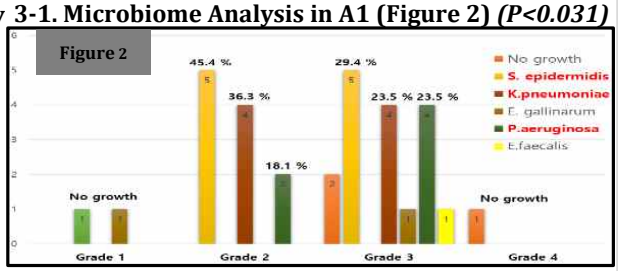

Figure 2

3-2. Microbiome Analysis in A2 (Figure 3) *(P=0.115)*

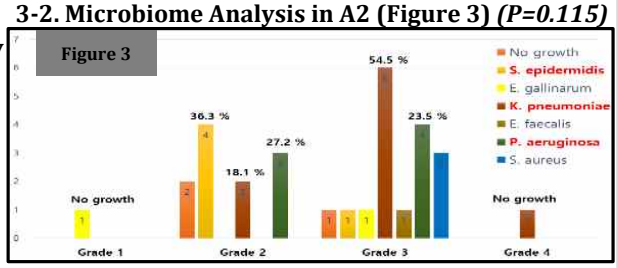

Figure 3

3-3. Microbiome Analysis in A3 (Figure 4) *(P<0.006)*

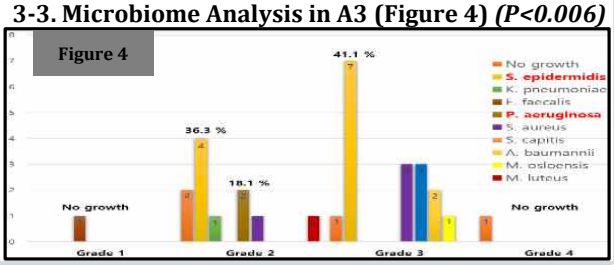

Figure 4

Conclusion

- The pressure injury area was more alkaline to the injury center than the normal skin barrier (pH: A1 > A2 > A3).
- Anaerobes such as KP, PA were mainly identified in the G2 or G3 than G1.
- Through this study, we want to confirm the difference in the skin pH and microbiome according to the severity of pressure injury. And pathophysiologic results of this pressure injury will be an important basis for the prevention and treatments of pressure injury later.