**Antimicrobial Hernia Mesh:**

**Plasma Activated Diallyldimethylammonium Chloride Coating**

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**Background**

More than 20,000 US hernia cases each year.

- Frequency of hernia mesh complications:
  - Inguinal repair ranges from 2.3% to 20%.
  - Femoral hernias range from 11.8% to 75%.

- Other hernia complications:
  - Seroma, persistent pain, tissue adhesions, and wound infection.
  - Infection is the third major complication after hernia mesh implantation [1].

**Approach**

Plasma induced antibacterial hernia mesh to prevent bacterial infection.

- Radio frequency plasma activates mesh surface with diallyldimethylammonium chloride (DADMAC) and pentaerythritol tetraacrylate (PETA) crosslinker [2].
- Prevents late bacterial infection.
- Inexpensive and easy method to apply.
- Tension-free mesh helps recovery and reduces recurrence.

**Results**

**Water Contact Angle**

<table>
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<tr>
<th>PP mesh control</th>
<th>DADMAC treated mesh</th>
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**Effect of Antibacterial Grafting**

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<th>Log value of E. coli number per ml</th>
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<td>DADMAC treated mesh</td>
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**Live/Dead Day 3**

- 500 x 500 \( \mu \)m
- TOF-SIMS Analysis

- PP control (C\(_3\)H\(_6\)O\(_2\))
- DADMAC mesh (C\(_3\)H\(_6\)O\(_2\))
- DADMAC mesh (C\(_5\)H\(_4\)N\(_2\))

**Conclusions and Future Work**

- Successfully activated both sides of the polypropylene mesh surface by using He/O\(_2\) radio frequency plasma.
- Successfully grafted uniform coating of DADMAC on both sides of the polypropylene mesh.
- Nitrogen positive ions were detected on the DADMAC treated mesh surface by acid dye and TOF-SIMS to confirm the presence of DADMAC coating.
- The bacteriostatic rate for DADMAC treated mesh was calculated for both E. coli (at 86.8%) and for S. aureus (99.9%). The DADMAC treated samples indicated significant reduction in bacteria load compared to the untreated control sample.
- In the future, optimize power level and time for the atmospheric pressure radio frequency plasma system to improve the durability of DADMAC coating.
- *In vitro* assays to evaluate cell attachment and mesh biocompatibility will be undertaken.
- *In vivo* animal trials will demonstrate clinical relevance.

**References**


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