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3 **Title: Introducing “Antimicrobial Brachytherapy” Protocol for Chronic PJI in TKA: Case Series**

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5 **Abstract**

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7 **Background:**

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9 Success rates treating chronic periprosthetic joint infection (PJI) have plateaued in the last two decades
10 utilizing exchange protocols combined with extended parenteral antimicrobials. The defined challenge
11 is to improve local site eradication while avoiding systemic complications related to extended
12 parenteral microbial treatment. This study introduces a tactical treatment shift focusing on local
13 microbial biocidal treatment, that we aptly name “antimicrobial brachytherapy” protocol (ABP).
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15 **Methods:**

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17 A consecutive series of 25 patients with chronic PJI in total knee arthroplasty (TKA) were treated with
18 the ABP from 2019 to 2023. In brief, the protocol includes: 1) local multimodal antimicrobial therapy
19 applied during debridement to reach and extinguish microbial reserves, 2) eschewing parenteral
20 antimicrobial therapy to maintain host-microbiome balance and 3) employing variable explantation
21 times (longer when needed) via a 1.5 exchange technique allowing individualized host and limb
22 rejuvenation. Patients were graded according to McPherson host scoring. Musculoskeletal Infection
23 Society (MSIS) tier levels were used to rate success. All patients had a minimum two-year follow-up.
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25 **Results:**

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27 The majority of patients were significantly compromised with B & C hosts having 2 & 3 limbs comprising
28 80% of the study cohort. Outcomes using the MSIS tier rating show 16/25 (64%) tier 1 success (infection
29 free without antimicrobial suppression). In these 16 patients, 3 were still using their 1.5 implant at a
30 mean 4.2 years (2-5.5 years). There were two (8%) tier 3C outcomes (aseptic revision at 3 and 5
31 months), and six (25%) tier 3E failures with 4 amputations for continued infection, and two who
32 underwent a repeat 1.5 exchange for continued infection. Of the 4 patients amputated, 3 had fungal
33 microbes identified in post-resection aspirations. Lastly, there was one (4.15%) tier 4a outcome
34 (mortality at 8 weeks).
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36 **Conclusion:**

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38 The ABP concept is a tactical shift focusing antimicrobial therapy within the zone of infection, avoiding
39 long course parenteral antimicrobials, and allowing variable explantation time for host & limb
40 rejuvenation. Success was comparable to published MSIS Tier 1 outcomes using traditional two-stage
41 exchange protocols. The ABP’s rationale and early results justify further rigorous evaluation and
42 refinement.
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