



# Rifampin and tobramycin combination with PMMA antibiotic cement

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## Abstract

Rifampin is a powerful antibiotic used in the treatment of biofilm-forming bacteria with studies supporting its use in PMMA cement. However, it has not been widely accepted for its use in PMMA cement due to a perception that it is unable to solidify in a timely manner. The technique described consists of ratio of aminoglycoside and rifampin that reduces time to solidification to approximately 15–20 min.

**Keywords** Tobramycin · Rifampin · Polymethylmethacrylate · PMMA · Antibiotic cement

## Introduction

Aminoglycoside powders have been widely used in the preparation of antibiotic laden polymethylmethacrylate (PMMA) cement. Aminoglycoside PMMA cement combinations are commercially available as premixed powders. Aminoglycosides, such as tobramycin or gentamicin, provide broad spectrum coverage with a low allergy profile [6]. However, other antibiotics may be required to deal with resistant microorganisms.

Rifampin is highly effective for the treatment of biofilm-forming bacteria. Rifampin acts primarily through inhibition of RNA polymerase. While its effectiveness in treating biofilm-forming bacteria is associated with rifampin's excellent diffusion properties, activity is independent of bacterial division and ability to coat implant surfaces [1, 2]. Studies have shown that rifampin can be integrated into PMMA cement and eluted at an effective concentration [1, 2]. A perceived limitation of rifampin is the amount of time it takes for the antibiotic cement to solidify, with studies claiming that the polymerization process can take up to 1 h [2]. We believe that this has led to surgeon avoidance of rifampin despite its efficacy in the treatment of biofilms. We propose

a technique that reduces rifampin polymerization time with PMMA cement to approximately 15–20 min.

## Surgical technique

### Materials

The materials necessary to prepare the cement nail include:

- One or two packs of bone cement. The authors prefer Simplex Cement (Stryker Orthopedics, Rutherford NJ).
- Tobramycin powder 1.2 g vial (per each ½ vial of rifampin powder).
- Rifampin powder 300 mg. The authors use one half vial of rifampin 600 mg powder.
- For beads hand mix in a bowl, for nails use cement gun.

### Antibiotic cement preparation

Tobramycin powder (1.2 g) is combined with rifampin powder (300 mg) and one pack of bone cement powder and mixed thoroughly. The dry powders and PMMA cement are mixed dry prior to initiating polymerization. When monomer is added, the mix turns a dark brown or reddish color.

Once the mixture is doughy, it can be either molded into clumps to form beads or placed into a chest tube with an Ender nail to form an antibiotic rod [7, 8]. With the described technique and adequate mixing of dry powders prior to polymerization, cement solidification took roughly 15–20 min (Fig. 1).

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**Fig. 1** Tobramycin and rifampin PMMA antibiotic beads on a twisted wire

## Discussion

Biofilm-forming bacteria have proven to be extremely difficult to treat once infection is established within bone. Improved outcomes are seen with early intervention and direct delivery of antibiotic [3–5]. Given the resistant nature of biofilm-forming bacteria and the long-term effects on patient outcomes, antibiotic selection is of critical importance. With research suggesting that rifampin is one of the

most effective medications in removing biofilms, its incorporation into the antibiotic cements is worth the few additional minutes it takes to prepare. We encourage surgeons to incorporate the use of rifampin into antibiotic cements when dealing with patients who currently or are at increased risk for biofilm-forming infections.

## Compliance with ethical standards

**Conflict of interest** No authors involved in this study have any conflict of interests pertaining to this study in particular. Please contact corresponding author with all other questions, comments and/or concerns.

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