

A study on mechanical and antibacterial properties of increasing concentration of antibiotic in bone cement.

¹Chun Haw, Bong; ²Cindy, Teh ; ¹Vivek, Ajit Singh

¹Department of Orthopaedic Surgery ²Department of Medical Biology, Faculty of Medicine, University of Malaya, Kuala Lumpur.

INTRODUCTION:

Endoprosthesis-related infection (ERI) in orthopaedic surgery is most devastating complications for both the patient and the surgeon. The economic magnitudes associated with treating ERI are significant¹. Since the FDA approved antibiotic-loaded PMMA in 2003, commercially premixed antibiotic PMMA has become available in the United States. However, surgeons continue to manually mix higher concentration of antibiotic into PMMA. In this study, we will look into the issue on modification of mechanical properties and antibacterial activity after addition of antibiotic at increasing concentration of Vancomycin.

MATERIALS & METHODS:

We evaluated the mechanical effects of adding Vancomycin at increasing concentration (up to 4gram) to bone cement by 3-point bending test, and compare them with control and commonly used commercially premixed antibiotic PMMA (Simplex P[®]). Meanwhile, we also examine the antibacterial activity of them at increasing concentration of Vancomycin by measuring the zone of inhibition (ZOI).

RESULTS:

The addition of Vancomycin in the PMMA will compromise the cement's mechanical properties. It showed that addition of 3 grams or more of Vancomycin added into PMMA would significantly weaken the strength and stiffness of PMMA. The antibacterial activity after manual addition of Vancomycin is better than plain PMMA and commonly used commercially premixed antibiotic loaded PMMA.

DISCUSSIONS:

In this in vitro study, we found that higher the concentration of antibiotic loaded into the PMMA, higher the degree of antibacterial activity. However, the mechanical strength of this PMMA was inconsistent and unpredictable within the same group of PMMA disc, the strength of PMMA is inconsistent. In the clinical setting, when we use the manually blended antibiotic PMMA with the purpose of providing mechanical strength, the outcome can be unpredictable. Therefore, we should limit the use manual blended antibiotic loaded PMMA for eradication of infection rather than mechanical support in case such as stage 1 revision endoprosthesis as part of a 2 stage revision process. We recommended the maximum amount of Vancomycin to be added is 2gm, because the addition of 3gm or more of Vancomycin significantly weakens mechanical strength of the cement but antibacterial activity doesn't increase significantly

CONCLUSION:

When considering the use antibiotic impregnated PMMA as antibiotic spacer, where temporarily mechanical support is required, the maximum concentration of Vancomycin should less than 3gram per pack of cement.

REFERENCES:

1. Fernandez-Fairen M, Torres A, Menzie A, et al. Economical analysis on prophylaxis, diagnosis, and treatment of periprosthetic

infections. The open orthopaedics journal
2013;7:227-42.