

## COMPARISON OF BIOCOMPATIBILITY BETWEEN PDMS AND PMMA AS PACKAGING MATERIALS FOR THE INTRAVESICAL IMPLANTABLE DEVICE: CHANGES OF MACROPHAGE AND MACROPHAGE MIGRATORY INHIBITORY FACTOR

### Hypothesis / aims of study

The implantable medical devices such as urethral and double-J catheters have been widely used in the various medical fields as well as urology. Although the present urologic implantable devices are made of the biocompatible materials, some patients can experience urinary tract infection associated with the devices. In addition, there have been several attempts to develop implantable devices such as implantable intravesical volume or pressure monitoring sensors, and we also reported a type of sensor to monitor intravesical pressure changes. Therefore, it is necessary to develop biocompatible packaging materials for the urologic implantable devices. And, recently, the role of macrophage migratory inhibitory factor (MIF) in the various inflammatory diseases has been reported, however, the studies about its influence on foreign body response were lacking. Thus, we evaluated the biocompatibility of polydimethylsiloxane (PDMS) and polymethyl methacrylate (PMMA) by analyzing of the changes of macrophage, MIF and inflammatory cytokines of the bladder.

### Study design, materials and methods

The 2 kinds of polymer, PDMS and PMMA were chose for the implanted materials in the bladder. A 2 mm-sized, coin-shaped lead was made and coated with PDMS or PMMA. Rats were divided into 4 groups: control (n=15), rats implanted with lead in the bladder (n=15), rats implanted with PDMS-coated lead (n=21) or PMMA-coated lead (n=21) groups. After 1, 2, 4 weeks, the level cytokines associated with foreign body reaction (IL-6, TNF- $\alpha$ , IL-4, and IL-13) was checked of the bladder. And the expression degree of macrophage and MIF were compared in the bladder tissue at 1, 2, 4 weeks after implantation.

### Results

After 1, 2, and, 4 weeks, the level of macrophage activation cytokines such as IL-6 and TNF- $\alpha$  and macrophage fusion cytokines such as IL-4 and IL-13 of the bladder in rats implanted with PDMS- or PMMA-coated lead were significantly lower than that of the rats implanted with leads. At 1 week, the increased expression of macrophage in the urothelium was observed except control group, however the significantly decrease expression of macrophage of the urothelium in rats implanted with PDMS- or PMMA-coated lead was noted at 2 and 4 weeks. Moreover, the significantly decreased expression of MIF was observed in the urothelium of the rats implanted with PDMS- or PMMA-coated lead. In addition, the lower expression of macrophage and MIF expression was noticed in the rats implanted with PMMA-coated lead than PDMS-coated lead.

### Interpretation of results

PDMS or PMMA were used to package the lead. Lead is a toxic material, therefore, it is not usually used to make the medical devices. However, we used lead to present the efficacy of packaging and biocompatibility of the PDMS and PMMA. After PDMS or PMMA coated leads were implanted in the bladder, there was no harmful effect which might be meant the extravasation of toxic materials from lead on the bladder. The role of macrophage and inflammatory cytokines which participate in the foreign body response is well known. Although MIF is a cytokine to have a role in the various inflammatory conditions or diseases, a little study about the influence of MIF on foreign body reaction was done. In this study, we noticed the expression of MIF in the urothelium and presented the changes of MIF as well as macrophage and other inflammatory cytokines. From these results, we suggest that the role of MIF in the foreign body response. Recently, the studies to use PMMA as a material or packaging for the medical devices were done in the various medical areas but not in urology. Thus, we introduced the possibility of PMMA as a biocompatible material for the development of urologic medical devices from this result.

### Concluding message

After the intravesical implantation with PDMS or PMMA, the lower inflammatory response was observed in the bladder. Therefore, PDMS or PMMA are suggested for the biocompatible polymers in the bladder. Moreover, PMMA may be more appropriate materials for the intravesical implantable device because PMMA showed less early inflammatory response compared with PDMS.

### References

1. Neurourol Urodyn. 2010 Nov;29(8):1451-7
2. Biochem Mol Biol Int. 1996 Jun;39(3):529-37

### Disclosures

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