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An *in vitro* study to evaluate the antimicrobial activity of a shunt catheter against *Propionibacterium acnes*

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Background

Infection is the major complication of shunt placement for hydrocephalus. *Propionibacterium acnes* is an anaerobic Gram positive rod-shaped skin bacterium, and a recognised cause of shunt infections. The clinical presentation in *P. acnes* shunt infections is delayed, and is under-diagnosed due to lack of anaerobic culture conditions and the need for laboratory incubation periods of at least 14 days. As the evidence supporting antimicrobial prophylaxis for shunt infections is weak, antimicrobial catheters have been developed. This project aimed to evaluate the protective effect of an antimicrobial shunt catheter, Bactiseal® (Johnson & Johnson Professional Inc., Raynham, USA), against *P. acnes* and to monitor the development of resistance by this bacterium.

Materials and methods

Bactiseal® shunt catheters were supplied by Codman. Three methods were used to evaluate the antimicrobial activity of the catheter. The Serial Plate Transfer Test (SPTT) is a screening test for the duration of antimicrobial activity and to monitor resistance. Catheter segments were placed onto agar plates seeded with *P. acnes* and incubated anaerobically. Every 7 days, segments were removed and placed on fresh plates and reincubated. The inhibition zone was measured across the short axis. This was repeated until no inhibition zones were seen. In the second method, time taken to kill 100% of *P. acnes* attached to catheter segments (tK100) was determined by allowing *P. acnes* to adhere to plain and antimicrobial catheter seg-

ments and incubating them. Three samples were retrieved daily, sonicated to remove the adherent bacteria, and the sonicate cultured quantitatively to detect *P. acnes* growth. Thirdly, a simulated *in vitro* model was used to determine the ability of the antimicrobial shunt catheters to resist successive *P. acnes* challenges every 14 days under constant perfusion, designed to mimic the CSF flow.

Results

The SPTT showed duration of antimicrobial activity for 70 days. The tK100 showed that it takes 96 hours to kill all the *P. acnes* attached to the catheter. The *in vitro* model showed that the catheters protected against *P. acnes* colonization after 5 successive challenges (ie up to 70 days). Also, no resistance was found.

Conclusion

This is the first *in vitro* study to evaluate the antimicrobial activity of Bactiseal® against *P. acnes*. The findings of this study indicate that the antimicrobial catheter is likely to reduce shunt infections caused by *P. acnes*.

References

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