

Antimicrobial Activity of a CHG-Impregnated Gel Pad for IV Site Protection

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Background

There are approximately 8 million central venous catheters (CVCs) and 160 million peripheral IV catheters (PIVs) placed in the U.S each year. The use of catheters provides an access point for bacteria to enter the body, and places the patients at risk for local and systemic infectious complications. Catheter-related bloodstream infections (CR-BSIs) are currently at an average rate of approximately 80,000 episodes per year. Skin flora at the insertion site is the most common source of catheter colonization within the first two weeks of insertion¹.

Objectives

A catheter securement device has been developed consisting of a gel pad composed of CHG dissolved in a soft polyglycerol gel pad as an integral part of a transparent adhesive dressing (TAD). The gel pad has been designed to integrate securement at the insertion site, visibility of the site through the dressing, and protection from outside contamination with CHG. These 2 studies compare the *in vitro* antimicrobial effectiveness of the CHG gel pad to a commercially available CHG impregnated protective disk.

Method 1: Sustained Activity

The CHG gel pad (3M™ Tegaderm CHG IV Securement Dressing) was compared to a CHG impregnated protective disk (BIOPATCH® Antimicrobial Dressing with CHG (Ethicon)) for sustained *in vitro* activity over a 10 day period.

1. *Staphylococcus epidermidis* (ATCC 12228) from an overnight culture was spread over the surfaces of Mueller-Hinton (MH) agar plates.
2. Gel pads and disks (n = 3) were placed onto the agar surfaces and incubated overnight at 35°C.
3. The clear zones surrounding the gel pads and disks were measured and recorded.
4. Each sample was transferred daily to agar plates freshly inoculated with bacteria and incubated overnight. This was repeated for 10 days.

Results

Zones of inhibition in agar from the CHG gel pad and the CHG disk were observed on all 10 days. The zone sizes were comparable between the CHG gel pads and CHG disks.

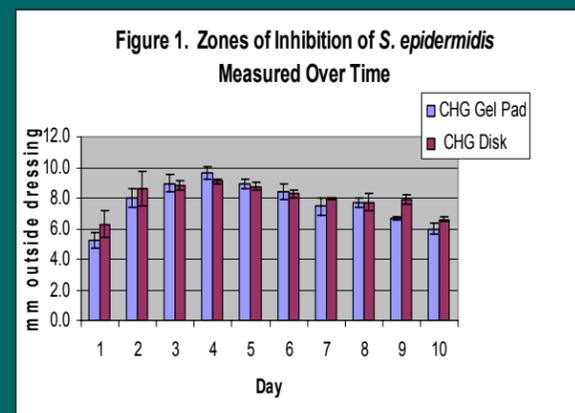


Figure 1: Diffusion study. The bars represent the mean widths of the inhibition zones around each sample before they were transferred to freshly inoculated agar plates. Standard deviations for the 3 replicates are noted by the error bars.

Method 2: Surface availability

This experiment evaluated the presence of CHG on the surfaces of the CHG gel pad and CHG disk in the absence of additional moisture. The method was designed to transfer surface CHG from the samples to inoculated agar, where CHG activity would be demonstrated by a zone of inhibition.

1. Dry polypropylene membranes (1 inch diameter, Pall Corp) were placed in contact with the surfaces of a CHG gel pad and CHG disk for 1 hour at ambient temperature.
2. The membranes were then transferred onto the surfaces of MH agar inoculated with *S. epidermidis*, and incubated overnight at 35°C.
3. The membranes were removed to observe the growth of the bacteria within the agar.

Results

The control membrane and the membrane in contact with the dry CHG disk were similar—neither had any affect on the growth of the bacteria. The clear zone in the center of the agar in Photo C (below) results from bacterial inhibition. This demonstrates that the dry membrane that was in contact with the CHG gel pad picked up and transferred active CHG from the surface of the gel to the agar, without the benefit of any additional moisture.

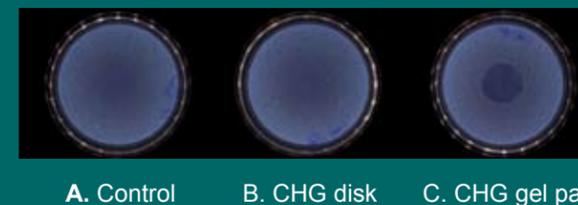


Figure 2: CHG surface availability. These images show the appearances of the agar after the membranes were removed. (A) Control membrane, no contact with either product, (B) Membrane from CHG disk, (C) Membrane from CHG gel pad.

Method 3: CHG Diffusion

This experiment demonstrated the diffusion of CHG from the CHG gel pad through the agar to areas not in direct contact with the agar surface.

1. Day 1: A section of catheter was cut and placed directly onto MH agar. A CHG gel pad was laid over the catheter. The plate was incubated for 24 hours at 35°C.
2. Day 2: Gel and catheter section were removed from the plate. A suspension of *S. epidermidis* (ATCC 12228) was spread over the plate's surface and incubated for an additional 24 hours at 35°C.
3. Day 3: Plate surface was observed for growth within the zone of inhibition.

Results

The inhibition of the bacteria under the catheter in the agar, demonstrates the diffusion of CHG throughout a moist environment to protect areas not in direct contact with the gel pad. The principle of CHG diffusion around the catheter is supported by the availability of CHG in solution form and the soft conformability of the gel to the catheter and skin.

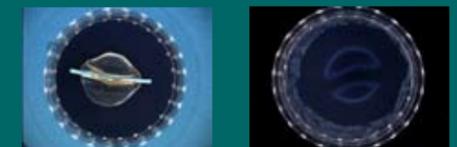


Figure 3. Photo on left: experimental setup on Day 1. Photo on right: growth on Day 3. The imprint left by the gel pad is visible in the photo on the right.

Conclusions

After transferring the same samples across agar plates for 10 days, the CHG gel pad and the CHG disk showed similar *in vitro* antimicrobial activity throughout the 10 day period. However, CHG in the CHG gel pad is already in solution, so requires no moisture to dissolve CHG within the gel. Therefore, the CHG on the surface of the gel is active and available upon application to provide antimicrobial protection at the insertion site. The concept of CHG migration with moisture to protect areas not in direct contact with the CHG gel was demonstrated by diffusion throughout agar.

¹Mermel, L.A., McCormick, R.D., Springman, S.R., & Maki, D.G. (1991). The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: A prospective study utilizing molecular sub-typing. *American Journal of Medicine*, 91, 197S-205S.