

## An assessment of the effectiveness of anti-microbial breathing system tubing against a range of micro-organisms

### Introduction

Infection control is a major area of concern in every hospital. Numerous guidelines are set out to try and protect both patients and staff from Hospital Acquired Infections (HAI). It is believed that nine percent of hospital in-patients suffer an infection following their admission to hospital.<sup>1,2</sup> These infections can vary from minor to life threatening and all pose numerous additional burdens on the hospital including a financial one. A recent study into the socio-economic burden of HAI suggested that an additional £3.6 million was required for one health care trust to meet the care of patients with Hospital Acquired Infections.<sup>3</sup>

Whilst every hospital does what it can to reduce the risk of HAI a large body of clinical evidence links levels of environmental hygiene and hand transmission of micro-organisms as major factors in causing HAI<sup>4,5,6,7</sup>

Reducing the numbers of micro-organisms in the environment may help reduce the risk of cross infection. This can be achieved in a number of ways and various different material additives have been developed that can be incorporated into everyday items to reduce levels of microbial contamination. In the medical field, work has been carried out investigating the effectiveness of such additives in venous and urinary catheters as well as other implants.

The Intersurgical Silver Knight range has an anti-microbial additive in the breathing system tubing that uses silver ions to disrupt the normal enzymatic activities of microbes preventing their proliferation.

In this study a specified level of a silver ion anti-microbial additive was introduced during production of low-density polyethylene tubing. The potential for microbial growth on this anti-microbial tubing was then compared to standard product using the protocol outlined and test organisms outlined below.

### Test organisms

The Nosocomial Infection National Surveillance Service (NINSS) report on the Surveillance of Hospital Acquired Bacteraemia<sup>8</sup> indicates that there are a number of micro-organisms which contribute to the majority of Hospital Acquired Infections. The following range of organisms were evaluated to establish the extent of effectiveness of the anti-microbial tubing:

- Methicillin Resistant Staphylococcus Aureus (KB-1005)
- Staphylococcus epidermis (NBRC-12689)
- Pseudomonas aeruginosa (IFO-13277)
- Klebsiella pneumoniae (NBRC-13889)
- Acinetobacter calcoaceticus (IFO-13006)
- Escherichia coli

### Method

Preparation of Bacterial Inoculum Nutrient broth was diluted 500 times and adjusted to pH 7. This 1/500 nutrient broth media was transplanted with the bacterial strain and used as the inoculum.

#### Preparation of Test Samples

Samples of 50 mm tube cut from the product. All surfaces of the test pieces were cleaned with gauze containing ethanol and allowed to dry.

#### Procedure

Each test piece was placed in sterilised petri dishes and 0.5 ml of the inoculum (containing  $>1.0 \times 10^5$  colonies) was dropped onto the surface of the test piece. The sample was then covered with the lid of the petri dish and incubated at  $35 \pm 1^\circ\text{C}$  and RH 90% or higher for the test period.

A test control and a control breathing system containing no anti-microbial additive were run in duplicate to ensure strain viability and test consistency.

#### Measurement of viable cells

At the end of the test time the inoculum was washed off the samples with 10ml of diluent. Following serial dilution on to Tryptone Soya Agar and incubation at  $35 \pm 1^\circ\text{C}$  for 40-48 hours the remaining viable cells were counted and the log reduction in growth established.

#### E.Coli Method

Silver Knight breathing systems (2025/2026) underwent 7 day simulated use conditioning. Samples were then taken and placed in individual sterile petri dishes. Antibacterial activity was determined using the method outlined in ISO 22196:2007.

### Results

The anti-microbial breathing systems exhibited a 99.9% reduction in viable organisms as compared to the control tubing after 24hrs. The anti-microbial effectiveness of the breathing systems was undiminished following 168hrs incubation (See Figure 1 overleaf).

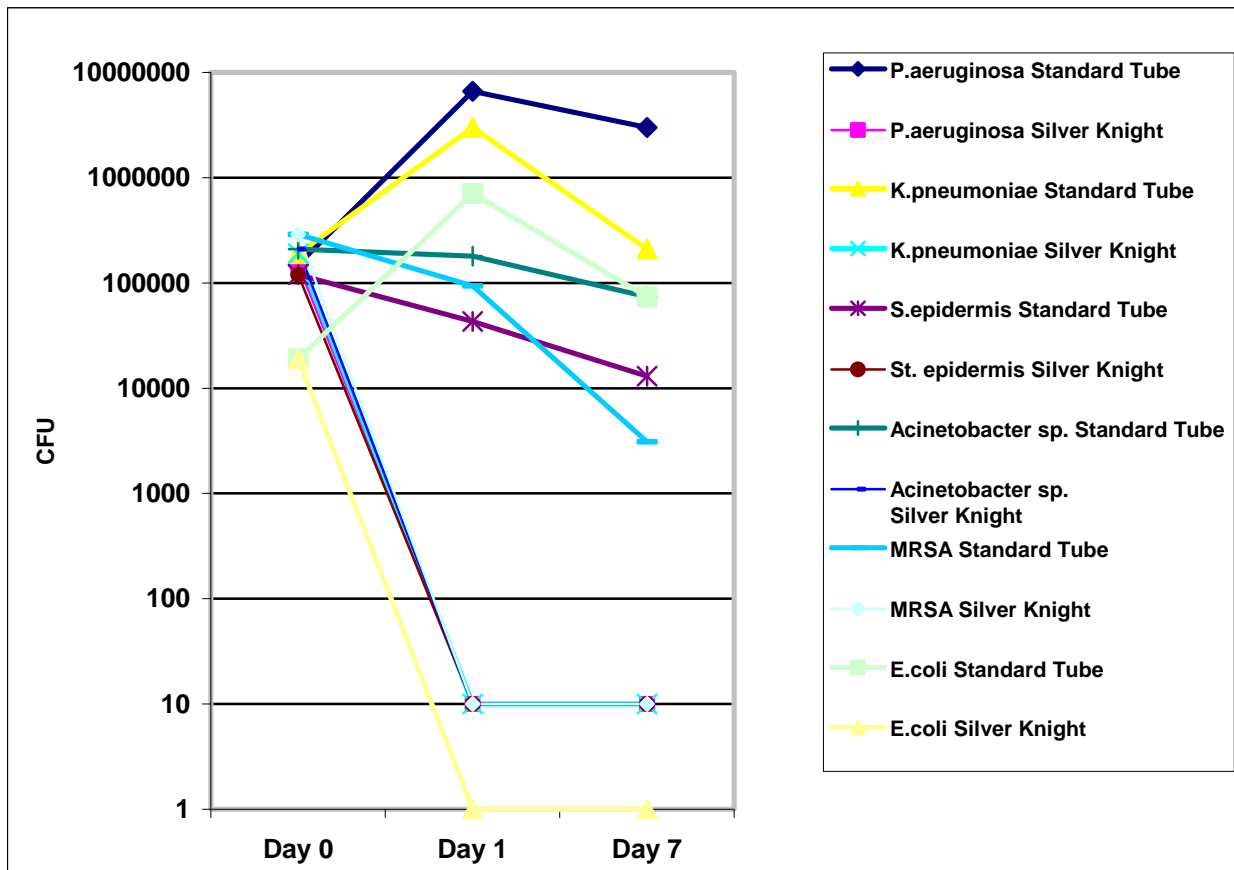
#### E.coli results

Reduction compared to the initial population after 24hours was  $\geq 99.99\%$

### Conclusion

The addition of the silver ion anti-microbial additive to Intersurgical breathing system tubing greatly reduces the viable microbial count level over time. The tubing has demonstrated a long lasting anti-microbial effect against a broad range of micro-organisms responsible for Hospital Acquired Infections

Fig. 1 The Effectiveness of anti-microbial breathing system tubing versus a range of micro-organisms<sup>9</sup>



## References

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### Note:

The additive does not completely remove the presence of all contaminants. It is essential that proper infection control procedures are followed at all times. The patient should always be protected with an appropriate breathing system filter and the breathing system replaced inline with the theatres clean down procedures

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