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The use of Surgihoney to prevent or eradicate bacterial colonisation in dressing oncology long vascular lines

- **Objective:** A pilot evaluation was performed to assess the effects of Surgihoney, an engineered honey with highly active antimicrobial activity, on bacterial colonisation in long lines in oncology patients.
- **Method:** This prospective service evaluation was conducted at Hampshire Hospitals NHS Foundation Trust (HHFT) in England, UK, between 2012 and 2013. The study population consisted of oncology patients with central intravenous lines who were receiving outpatient chemotherapy. All patients were offered line dressing with or without Surgihoney, applied to the line exit site.
- **Results:** The primary outcome measure of the study was the presence or absence of bacterial colonisation of the line site. There were 30 patients in each arm – with or without Surgihoney. In the Surgihoney arm, 2 patients with existing line site colonisation were cleared of bacterial colonisation and none acquired colonisation during the study period. In the non-treatment arm, 6 patients were colonised at the line site prior to screening or during the evaluation. Bacterial colonisation was maintained throughout the period.
- **Conclusion:** Surgihoney is an effective antimicrobial line-site dressing, significantly reducing line site colonisation and eradicating existing colonisation. It was well tolerated by the patients.
- **Declaration of interest:** Surgihoney supplies were donated by Healing Honey International (HHI) who also provided some funding to Hampshire Hospitals Foundation Trust for microbiological investigation. MD and JC have provided clinical advice in an advisory capacity to HHI.

honey; central lines; IV line infections; exit site; immunocompromised

M. Dryden,¹ MD, FRCPATH Consultant;
C. Tawse,¹ MBBS, FY1 Doctor;
J. Adams,² Ward Sister;
A. Howard,² Charge Nurse;
K. Saeed,¹ FRCPATH Consultant;
J. Cooke,³ Professor, MPharm, PhD, MRPharmS;
¹ Department of Microbiology, Hampshire Hospitals NHS Foundation Trust, Winchester, UK;
² Department of Oncology, Hampshire Hospitals NHS Foundation Trust, Winchester, UK;
³ Centre for Infection Prevention and Management, Division of Infectious Diseases, Department of Medicine, Imperial College, London, UK.
 Email: matthew.dryden@hhft.nhs.uk

Oncology patients receive chemotherapy through intravascular lines which are usually inserted surgically, tunneled under the skin, and enter one of the central veins. So-called long lines may remain in place for weeks and sometimes months. A major preventable complication of long lines is line infection and bacteraemia. Intravascular catheter-related infection rates vary from 0.08 per 1000 days in oncology outpatients to 19/1000 catheter days in the critically ill, but when infection does occur, the risks are considerable.¹ Bacteria can gain entry in two ways: colonisation of the lumen, and colonisation at the point where the line enters the skin. Subsequent proliferation causes local inflammation and infection, spreading via the lumen or tunnel to cause bacteraemia, which may be life-threatening.¹ Common causes of line site colonisation or infection and bacteraemia in these patients are microorganisms which reside on the skin, including coagulase negative staphylococci and *Staphylococcus aureus*, in addition to opportunistic pathogens such as *Pseudomonas aeruginosa*.¹⁻³

Preventing infection requires firm adherence to aseptic techniques, in the insertion and care of these intravenous lines.¹⁻³ It also requires staff and

patients to be trained in aseptic procedure to avoid contaminating the line site during dressing changes or contaminating the line lumen at any stage.

The aim of this evaluation was to investigate the role of Surgihoney™ as a topical antimicrobial dressing at the line insertion site. Antimicrobial dressings are frequently used in this setting, and often contain chlorhexidine or silver. These may cause local toxicity, or in the case of silver, will cause skin staining. Using non-antimicrobial dressings is an option, however, this increases the risk of line site colonisation.³

Honey has been well established as a dressing for wounds, having both antimicrobial and healing properties.^{4,5} Surgihoney is a licensed sterile product based on natural, organic honey from a variety of sources, which has been developed for wound care and as a prophylactic dressing for wounds. The natural antimicrobial potency of the honey has been controlled through a proprietary manufacturing process to produce precise levels of antimicrobial potency through steady delivery of oxygen free radicals. These greatly exceed other honeys both in potency and broad spectrum microbial kill.^{6,7} Surgihoney is active against both Gram-positive and Gram-negative bacterial wound isolates and mini-

imum inhibitory and bactericidal concentrations are well below the therapeutic concentration of Surgihoney at superficial sites.^{6,7} In a pilot study looking at the prevention of surgical site infection in patients undergoing caesarean section surgery, Surgihoney was observed to reduce surgical site infections substantially compared to normal wound dressings, and thus offering considerable cost savings over other preparations.⁸

The aim of the current pilot study was to determine whether Surgihoney could prevent colonisation at the line exit site by incorporation in the line site dressing, and in cases where bacterial colonisation was already present at the line site, the aim was to establish whether Surgihoney was able to eradicate the bacterial colonies.

Methods

Patients were recruited in the outpatient oncology department at the Royal Hampshire County Hospital, Winchester. There had been recent patient issues with patients not tolerating antimicrobial dressings (silver dressings were causing skin staining) and so the current management was to use non-antimicrobial dressings. Oncology patients receive dressing changes to long lines once or twice a week. All patients presenting to the outpatient oncology service for chemotherapy or long line care were offered a choice of Surgihoney applied to the line site at dressing change or no Surgihoney. There was no formal randomisation and patients were informed that this was not a research study but a clinical service evaluation of an antimicrobial topical dressing which lasted for 3 months. For the purpose of this evaluation, data was collected on 60 patients, 30 with use of Surgihoney on their IV lines and 30 without. Data on median duration from line insertion for each arm was not collected, but as inclusion in either arm was patient choice, it is likely that both arms had a range of insertion dates.

All patients had line dressing changes using an aseptic technique (Fig 1). Surgihoney was applied as a small bleb at the line insertion site. The usual dressing (Opsite) was applied over the Surgihoney. Surgihoney was replaced at every dressing change, which generally occurred weekly. All patients had the line site swabbed at dressing change regardless of which therapy group they were in. Swabs were processed in the local microbiology laboratory.

Patients were trained in the management of their lines at home. In addition, they were instructed on how to avoid manual handling and contamination of the line lumen, and in how to avoid wetting the line. Patients were asked about their satisfaction with the dressing. They were asked about any adverse events, in particular itching, rash, and pain. Ward staff were asked about ease of dressing application.

In addition, line-associated bacteraemias in out-

patient oncology patients was monitored prospectively in the three months prior to the service evaluation and for three months during the evaluation.

Results

Thirty oncology patients in each arm (with and without Surgihoney) were evaluated. Both methods were equally tolerated by the patients and staff. Patients in the Surgihoney arm had a lower rate of line site colonisation and those whose line sites were already colonised cleared colonisation if they were in the Surgihoney arm but not if they were in the arm with the non-antimicrobial dressing (Table 1). A large number of line site swabs, totalling 426, were processed in this evaluation. The large majority of these yielded no bacterial growth, a testament to the aseptic techniques of the staff in the oncology outpatient service. Bacterial colonisation was with coagulase negative staphylococci in all patients except one patient in the Surgihoney arm, who was colonised with *Pseudomonas aeruginosa*. This was subsequently cleared with Surgihoney application. Two patients in the Surgihoney group demonstrated colonisation at early visits; this was also eradicated with successive Surgihoney application. Six patients in the non-intervention group either had or became colonised with coagulase negative staphylococci in the course of the evaluation and colonisation was maintained throughout the evaluation. The presence of line site colonisation was significantly lower in the Surgihoney group ($p=0.024$ Chi squared test).

Adverse events were reported by patients in both arms; itching, discomfort and pain at the line site were predominant. Rash and irritation was predominant in the Surgihoney group.

Fig 1. Hickman line site being dressed with Surgihoney

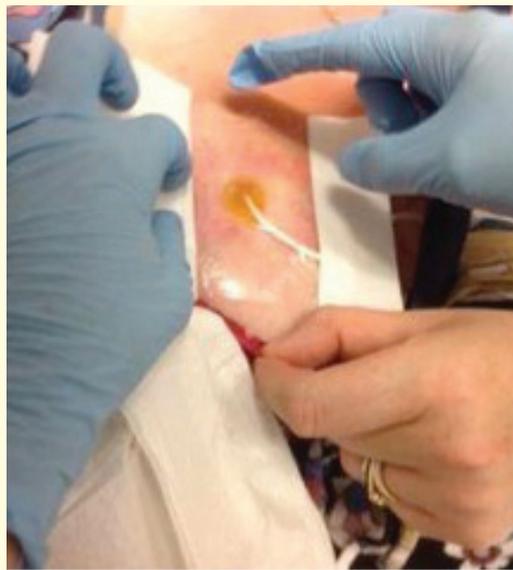


Table 1. Clinical findings during line site evaluation

	Surgihoney (30)	Non-Surgihoney (30)
Colonised at initiation	2	4
Colonisation during evaluation	0	6
Colonisation cleared during evaluation	2	0
Colonisation at the end of evaluation	0	6
Patient reported adverse events at line exit site		
Pain	2	2
Itching/ irritation	4	1
Rash	3	1
Discharge at exit site	1	0

Table 2. Cases of line associated bacteraemia in oncology patients

	Underlying source	Organism
Prior to Surgihoney intervention	PICC line	<i>Klebsiella oxytoca</i>
	Hickman Line	<i>Pseudomonas aeruginosa</i>
	PICC	<i>Micrococcus sp.</i>
	Hickman Line	<i>Staphylococcus epidermidis</i>
	Hickman line	<i>Brevibacter sp.</i>
	Hickman Line	<i>Staphylococcus epidermidis</i>
Post Surgihoney intervention	Hickman Line	<i>Agrobacterium radiobacter</i>

In the three month period prior to implementing the Surgihoney evaluation, there were 6 line-associated bacteraemias (Table 2). Over the three month study period, there was a single case of bacteraemia in a patient receiving Surgihoney line dressings. There were no bacteraemias in the group not receiving Surgihoney in this period. The single case in the Surgihoney group had the blood culture collected from the Hickman line. Peripheral blood culture was negative. The line site was not inflamed and there was no growth at the line site, so the bacteraemia was assumed to have occurred by intraluminal spread. The patient was treated with intravenous antibiotics and the line was removed.

Discussion

Surgihoney incorporated in a central line dressing reduces line site colonisation and is effective in eradicating existing line site colonisation. This has important implications for the potential reduction of local line site infection and the development of line associated bacteraemia, a life-threatening complication when associated with septic shock in immunocompromised oncology patients.⁹ Surgihoney is a licensed sterile product which has been developed as a prophylactic dressing for wounds. It consists of honey which has been modified or engineered to produce different potencies of antibacterial activity, which greatly exceed those

of other honey dressings.^{6,7} Interestingly, our observations are at variance with reports that another medical-grade honey did not reduce the frequency of positive skin cultures of CVC insertion sites of critically ill patients¹⁰ and that there was considerable heterogeneity of antibacterial action between honeys from different sources.¹¹ This study is the first to report on the use of Surgihoney, an engineered product quite different in antimicrobial properties from other honeys,^{6,7} in preventing line site colonisation and infection.

Honey has been used for decades as a topical wound therapy, based on observations of its healing properties and cleansing action on suppurating wounds.^{4,5,12-16} However, a recent review by the Cochrane group has been equivocal about the clinical benefits of medicinal honey for treating wounds.¹⁷ Furthermore, a well-designed, multicenter, prospective, randomised controlled trial in participants undergoing peritoneal dialysis were randomly assigned to daily topical exit-site application of antibacterial honey (Medihoney) plus standard exit-site care or intranasal mupirocin prophylaxis (only in carriers of nasal *Staphylococcus aureus*); results were equivocal.¹⁸ Interestingly, although honey and antiseptics were just as effective as each other in preventing infection, antimicrobial resistance, in this case to mupirocin, was not recorded in the patients receiving treatment with honey.¹⁹ It is therefore a significant development to have engineered Surgihoney with enhanced antimicrobial activity, superior to other medicinal honeys,^{6,7} and yet with similar healing properties and a lack of toxicity, which translates to reduced likelihood of antimicrobial resistance.^{4,5,11,12} In addition, Surgihoney has no agricultural additives or antimicrobial residues, unlike many commercially-available honeys. Surgihoney is not dependant on particular nectar sources, unlike honeys such as manuka which depends on a specific plant nectar source for its enhanced activity. Surgihoney is a honey product which is engineered by a novel, patented process to enhance and control the antimicrobial activity by a sustained delivery of oxygen free radicals to the wound site.

Many properties of honey, some enhanced in Surgihoney, have been put forward as mechanisms for wound healing and the prevention of infection. Honey may also play a role in preventing the development of, and disrupting bacterial biofilms,² an important aspect of successful intravascular line management.

The appropriate care of intravascular catheters is a key standard in health care and reducing hospital-acquired infection.²⁰⁻²⁴ Line infections are preventable complications which compromise therapy and lead to increasing morbidity and mortality.

Surgihoney as a dressing at the line exit site was

well tolerated, with some patients reporting minor irritation.

The ability of Surgihoney to clear colonisation is a notable property. Although the colonising organism species in this evaluation were limited and the numbers small, Surgihoney cleared colonisation of both Gram positive (coagulase-negative staphylococci) and Gram negative (*Pseudomonas aeruginosa*) organisms. One of the main risks from line site colonisation is colonisation with more pathogenic organisms, of which *Pseudomonas aeruginosa* is one, but *Staphylococcus aureus*, both methicillin-sensitive and-resistant, is common and beta-haemolytic streptococci may occur; both of these may cause severe localised soft tissue infection as well as bacteraemia. Surgihoney is active against both Gram-positive and Gram-negative organisms.^{6,7}

An interesting incidental finding was a reduction in line-associated bacteraemia during the study period. There was only one case of bacteraemia in the evaluation period in the oncology patients, compared to six in the same period prior to Surgihoney introduction.

Good line site care and prevention of line site colonisation plays an important role in preventing line site infection and bacteraemia, however, it is

likely that the majority of central line associated bacteraemia cases occurred as a result of luminal contamination. Controlling colonisation at the insertion site would not prevent these infections, so it is possible that the overall reduction in bacteraemia after Surgihoney was introduced was due not only to the antimicrobial effect of Surgihoney at the insertion site, but also to an improvement in aseptic line handling by increasing awareness of the problem, education and training around aseptic technique and line care in both staff and patients. This is worthy of further investigation.

The main limitation of this work is that it was a pilot observational study with small numbers and a retrospective comparison. A prospective randomised study, suitably powered, would be worthwhile conducting. Nevertheless, it is important to report the efficacy of this novel product at this early stage, to stimulate further interest in investigating the potential clinical roles of Surgihoney.

Conclusion

Surgihoney is an effective antimicrobial line site dressing, reducing and preventing line site colonisation and this evaluation supports its use in this role where it could play a significant role in preventing local soft tissue infection and bacteraemia. ■

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