Single-patient use electrocardiogram monitoring as a means of infection prevention: A healthcare simulation study in cardiac surgery

Rhodri Saunders[1], Eleftheria Pervolaraki[2]
1. Coreva Scientific, Germany; 2. Cardinal Health, England

Background

- Surgical site infections (SSI) place a large cost and care burden on service providers[1]
- Sternal wound infection (SWI) following cardiac surgery can be particularly devastating
- As reusable electrocardiogram leads and wires can hold vectors of infection after cleaning, a single-patient use cable and lead system (spECG) may help prevent cross-contamination
- The cost-benefit of implementing spECG is investigated in this simulation study

Methods

- NHS Digital data for cardiac surgeries taking place in January-December 2019 inclusive were assessed for SSIs occurring during the index event or associated with a readmission in the 90 days post discharge
- Only data from 88 centres performing ≥1,000 surgeries were included
- Combined outcomes data from these centres were used to update a published health-economic model[2] of the coronary artery bypass graft care pathway
- The modelled patient population had a mean age 68 years[3], 18% were female[3], 33% were obese[3], and 28% had diabetes[4]
- Costs are from NHS reports and are provided in 2019 GBP (£)

City	Cases	SSI rate	LoS due to SSIs (days)	Readmissions	Readmission LoS (days)
London	55,590	2.0%	28.8	480	15.6
Manchester	12,270	2.2%	31.7	95	15.2
Liverpool	10,930	1.8%	16.3	80	16.2
Birmingham	9,585	2.1%	37.3	75	20.5
Cambridge	8,890	2.5%	14.6	115	11.9
Bristol	8,455	2.0%	19.6	65	13.7
Leeds	7,780	1.7%	31.9	45	15.1
Middlesbrough	5,795	1.3%	25.3	25	8.7
Norwich	5,405	0.7%	15.5	20	14.1
Oxford	5,080	1.4%	19.9	35	10.7
Plymouth	4,395	1.8%	9.7	35	8.1

Table 1 Surgical site infection data for several English cities based on NHS data. When multiple hospitals reported outcomes, these outcomes where combined. SSI: Surgical site infection; LoS: Length of stay

Results

- The 88 centres reported a total of 317,825 cardiac surgeries, with **1.43% affected by an SSI**
- There were 2,580 in-hospital SSIs (0.81%), increasing length of stay (LOS) from 4.4 to **29.4 days**
- The 1,975 SSI-related, post-discharge readmissions (0.62%) had a mean LOS of **13.9 days**
- The reported key outcomes for several relevant cities can be seen in **Table 1**
- The model estimated cost of care was **£8,127** per patient, closely aligned to the reported data of £7,830 to £8,784[5]
- The national cost-burden of SSIs was modelled at **£45.8 million** per year, adding £144 per surgery
- The local burden caused by SSIs varied between £63 and £274 per patient **(Figure 1)**
- If spECG was implemented, the cost of care was reduced to **£8,094** per case
- The saving of £33 per case reflected a **3.5-fold return on investment**
- The saving was driven by fewer SSIs, resulting in reduced LOS and fewer readmissions. Individual hospital savings depend on the SSI rate reported

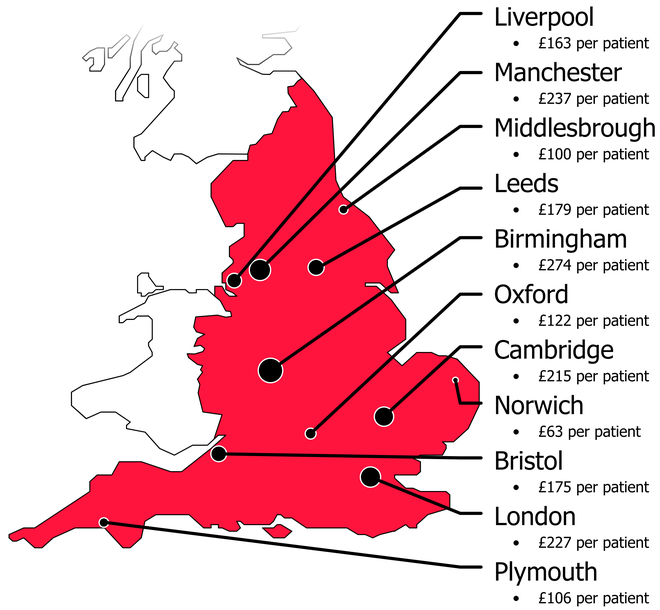

Figure 1 Local burden of surgical site infections calculated based on NHS data **(Tab.1)**. The size of the circles marking each city represents the burden per patient

Conclusion

- Hospital reported outcomes data are a powerful tool to estimate individualized burden and potential savings of innovative technology
- This simulation study suggests that use of spECG could provide cost-benefit by reducing the burden of SSIs related to cardiac surgery

Discussion

- The reported NHS data does not differentiate SSI rates for superficial and deep SSIs or clarifies the severity required to be considered an SSI
- The reported SSI rates are generally lower than reported in the literature[6] indicating that the SSIs here may have only been more severe cases
- The considerable variance of SSI rates between hospitals (0.2 to 3.2%) may partially be attributed to inconsistent definition of an SSI, inconsistent coding, or a different mix of cardiac surgeries

Disclosure
Research funded by Cardinal Health
RS is the owner of Coreva Scientific, which received consultancy fees for this work.
EP is an employee of Cardinal Health, which funded this research

Surgical Infection Society Europe Virtual 2021
June 9th - 11th, 2021

References

1. Findeisen A. et al. Eur J Cardiothorac Surg. 2018 Aug; 55(3):494–500,
2. Blüher M. et al. Front Public Health. 2020 Oct 23;8:557555
3. Elgohari, Thelwall, Lamagni: Surveillance of Surgical Site Infections in NHS hospitals in England. Public Heal Engl. (December):29 (2018)
4. Laverty AA et al. Cardiovasc Diabetol. 2017;16(1):1-13.
5. R040X: SPECIALTY GROUP COSTS - INPATIENTS IN ALL SPECIALTIES (EXC LONG STAY), cardiac surgery data used
6. European centre for disease prevention and control, Annual Epidemiological Report 2018, Healthcare-associated infections: surgical site infections