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Semi-automated surveillance of deep surgical site infections after cardiothoracic surgery

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Background: Deep surgical site infections (SSIs) following cardiothoracic surgery are serious and potentially life-threatening complications. Reliable and timely identification of these infections through surveillance is indispensable for targeted implementation and monitoring of preventive measures. Moreover, in the era of benchmarking and increasing public reporting requirements, standardisation becomes more important to warrant comparability of rates across institutions. Current manual surveillance strategies are labour-intensive and often lack a standardised case-finding method. Since clinical data sources are increasingly accessible through data warehouses, this enables the development of an algorithm to automatically and systematically select patients with a high probability of SSI for manual chart review. This study presents an algorithm that relies on routine care clinical data to retrospectively classify patients as having a low or high probability of a deep SSI after cardiothoracic surgery.

Material/methods: All adults who underwent cardiothoracic surgery through median sternotomy from 2012–2014 at University Medical Centre Utrecht were included. The reference standard was routine surveillance and consisted of manual chart review of all patients for whom at least one relevant microbiological culture was obtained. The outcome was any deep SSI –harvest site or sternal infection, including mediastinitis– occurring within 90 days after surgery. Ascertainment of SSI status was done by an infection control practitioner using the national surveillance definition. Data elements that could indicate the presence of a deep SSI were extracted from the local clinical data warehouse for a period of 120 days after surgery. Bivariate analyses identified the most important predictors of a deep SSI. Subsequent development of the algorithm focused on optimizing the positive predictive value (PPV) while maintaining 100% sensitivity and accounting for future variations in clinical practice.

Results: This study included 2590 procedures, of which 25 (1.0%) were complicated by a deep SSI (22 sternal infections, 3 harvest site infections). A relevant microbiological culture was obtained after 512 procedures (19.8%), which means that culture-driven case-finding, as done at present, had a PPV of 4.9%. An algorithm based on a combination of revision surgery, cultures, antibiotics and mortality resulted in 113 patients classified as having a high probability and a PPV of 22.1%, while maintaining 100% sensitivity. In terms of workload reduction, this means it suffices to manually assess 22.1% of the 512 medical charts currently evaluated in routine surveillance and 4.4% of all medical charts.

Conclusions: Semi-automated surveillance of deep SSIs has the potential to substantially reduce workload of manual chart review without loss of sensitivity. Future validation studies should determine the algorithm's robustness to practice variations. Nonetheless, even an algorithm employing less stringent criteria will considerably reduce workload.