Infections Post-Cardiac Surgery
New Information During Challenging Times*

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Surgical site infections (SSIs) are one of the most challenging complications of surgery, for patients and surgeons alike. For that reason, it is interesting to note that in this recent experience, reported by Gelijns et al. (1) in this issue of the Journal, of more than 5,000 patients who underwent various cardiac surgeries including cardiac transplantation, SSIs played only a minor role (1). The majority of infections observed were pneumonia, bloodstream infections, and *Clostridium difficile* colitis, which accounted for 79% of all major post-operative infections. Although we should not underestimate the importance of SSIs, the continued improvements in care delivery in recent years have had a significant impact on patients undergoing cardiac surgery.

Historically, institutions and surgeons assessed and reported only on their individual outcomes to improve their practice, as well as to reassure themselves and their patients about their quality of care. Over the last 20 years, cardiothoracic societies have been on the forefront to collect national data on cardiac surgery and its outcomes. Now, these data are available in the public domain. For that purpose, national societies such as the Society of Thoracic Surgeons and the Society for Cardiothoracic Surgery have developed databases in which surgical outcomes of their members are collected in standardized fashion, with the aim of covering the national activity for their specialty. These data have been used to create benchmarks and to identify areas of care, which could benefit from further improvements.

In numerous countries, including the United States and United Kingdom, we are entering an interesting next phase in that, outcomes after cardiac surgery—which include immediate and mid-term follow-up—will be directly correlated to reimbursement. In the United Kingdom, this is known as “Payment by Results” (PbR). In the United States, the Centers of Medicare and Medicaid Services (CMS) decided to withhold reimbursement for care relating to post-operative complications including SSIs, mediastinitis after coronary artery bypass grafting, urinary tract infections, and intravenous catheter-associated infections. For this reason alone, it is vital to know more about the incidence and associated risk factors for certain complications in a normal cohort of patients undergoing cardiac surgery today. The findings by Gelijns et al. (1) will hopefully influence healthcare providers when building new policies. Previous reports generally focused more on specific types of surgical procedures and reported on in-hospital or 30-day results. Gelijns et al. (1) provide vital information on a diverse cohort of patients undergoing cardiac surgery and include not only early but also mid-term outcomes up to 65 days after surgery. This astute approach has led to the finding that 45% of all post-operative infections occur after discharge. While this is important for the patients’ recovery, it also has significant economic implications as it leads to readmissions and delayed rehabilitation of patients.

When it comes to reimbursement and penalties of complications, it is of tremendous importance to distinguish between post-operative complications as a result of individual patient or surgical characteristics and those due to quality of care. In this investigation, the authors identify baseline patient demographics such as chronic lung disease, heart failure, and elevated creatinine as predictors of post-operative infections, while previously known...

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characteristics such as obesity, diabetes, and urgent surgery did not play a role. Given that surgeons and institutions cannot influence the risk profile of individual patients, healthcare providers should not scrutinize treatment of these individuals by the same financial penalties introduced for patients without a high-risk profile for cardiac surgery.

Alternatively, healthcare providers can expect a high standard of care, which is known to reduce complications such as infections. The authors provide important information on which medical practices reduce infectious complications after cardiac surgery. Perioperative prophylaxis using second-generation cephalosporins proved to be of prophylactic value in North America, but it should not be given for more than 48 h after surgery. In addition, post-operative hyperglycemia is identified as a significant risk factor for infections. While it is well known that post-operative normoglycemia improves patient outcome (2), it raises the question why diabetes mellitus was not a risk factor. It would be interesting to see if the subgroup of diabetic mellitus patients who are insulin dependent were found to be at higher risk for post-operative infections. However, these findings may support the CMS decision to introduce performance measures such as choice and timing of antibiotics, control of early post-operative blood glucose level, and appropriate surgical site hair removal into their reimbursement scheme.

When it comes to quality of care and surgery itself, it is important to notice that “prolonged surgery” in this report predicted infective complications, which aligns with previous studies. While surgery can be unavoidably prolonged due to the nature of certain surgical procedures (e.g., combined complex coronary artery bypass grafting and heart valve surgeries or thoracic aortic surgery), it also can be an indicator of inferior surgical care in cases of routine operations taking longer than expected. If both these patient groups would be affected by reimbursement penalties in the same way, it would not be difficult to imagine that patients who face high perioperative risks because of their individual characteristics or specific planned procedure, would be at risk of not finding surgeons or institutions prepared to take additional medical and economical risks in the future. This scenario needs to be avoided, as it is well known that these patients often have an even greater prognostic and symptomatic benefit from their surgery compared with patients who have lower risk profiles. Therefore, the question needs to be raised if these individuals and surgical procedures should be taken off the list of treatments affected by PBR?

What is not documented in this paper is data on how patients were screened for their infectious status prior to admission. This is of even more importance as the number of patients colonized with multiresistant microorganisms, such as MRSA, is steadily increasing. Therefore, pre-admission nasal and skin swabs should be a routine, standardized screening protocol for urgent or in-hospital patients. In this respect, it may be interesting that nasal decontamination in this investigation did not have a positive effect on the incidence of infections, in contrast to a previously published randomized trial (3). It does, however, raise the question of whether this is only due to the fact that most patients treated did not present with pathological nasal contamination and these results may have been different if treatment was selected only for patients with pathological colonization.

There are 2 findings in this investigation, which should further encourage us to review current standards of care. While the duration of mechanical ventilation is well known to have a negative effect on post-operative infections, blood transfusions have been more recently identified as independent predictors of negative outcome after surgery (4). Given that an intubation time of 24 to 48 h and mechanical ventilation of more than 48 h increases the risk of infections, it is of even more importance to have treatment protocols and close collaboration between surgeons and anesthesiologists in place, which enable early extubation post-surgery. In our own institution, post-operative ventilation time for all comers of cardiac surgery has been continuously reduced over recent years to a mean of 12 h, with 85% of patients extubated <6 h after cardiac surgery. As a result, the incidence of respiratory complications has been reduced, and <10% of all patients need to be admitted to intensive care facilities at any time after cardiac surgery. Reduction in the length of hospital stay and overall treatment costs are a positive side effect of this strategy.

In recent years, a number of investigations demonstrated that blood transfusions are an independent risk factor for inferior outcomes after surgery. Therefore, it was not surprising to read that this is also true for patients after cardiac operations. Unfortunately, hemoglobin thresholds for blood transfusions are not reported in this study and therefore we believe that they vary between the institutions or surgeons involved. In general, lower hemoglobin thresholds than previously advised should be used, as was recently recommended (5). In our institution, a hemoglobin of 8 g/l is currently accepted for cardiorespiratory stable patients after cardiac surgery. While a number of blood conservation strategies, such as
autologous transfusion and cell saving, have been well established, there is generally a less cohesive opinion among surgeons on how patients with preoperative anemia should be treated before surgery. This recently published data raise the question that if patients with preoperative anemia should undergo preoperative treatment using oral or even intravenous iron, which is suggested for other types of surgery?

In summary, we would like to congratulate the authors for this excellent investigation on a real-world cohort of patients undergoing cardiac surgery.

These data come at the right time as PbR is more frequently discussed, highlighting the challenge of fitting high-risk patients into these new reimbursement arrangements, without first addressing their individual risk profile or overlooking their medical needs.

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