Antibiotic stewardship in UK surgical departments: challenges and possible solutions

Abstract

Antibiotics are one of the most widely used classes of drugs within hospitals in the UK. They have a wide range of uses within all surgical specialties, both as preoperative prophylaxis and for treatment of acute surgical conditions. Antimicrobial resistance has increasingly been seen as a major issue, as the production of new antibiotics has decreased and overall use worldwide has increased. With the COVID-19 pandemic increasing concerns about antimicrobial resistance, there is an ever-increasing need for action. This article examines the particular challenges of antibiotic stewardship in surgical departments within the UK, and outlines possible solutions for improving adherence and reducing the risk of antimicrobial resistance in the future.

Key words: Antibiotic prophylaxis, Antimicrobial resistance, Antibiotic stewardship, Antibiotics

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Background

The threat of antimicrobial resistance has led to an increased focus on antibiotic stewardship programmes. These aim to optimise antibiotic use, with the goal of improving patient outcomes, reducing antimicrobial resistance and reducing associated healthcare costs. The UK government has an antimicrobial resistance and antibiotic stewardship strategy, with a new 5-year action plan published in 2019 (HM Government, 2019). The aim is a 15% reduction in the use of antimicrobials in the UK by 2024, with a targeted 10% reduction in hospitals. Although progress has been made in reducing the prescription of antibiotics within GP settings, there has been an 7.8% increase in their use in hospital inpatients since 2015 (Public Health England, 2020).

Antimicrobial resistance is a global problem. The World Health Organization implemented a campaign called AWaRe in 2019, as part of their work in containing rising antimicrobial resistance. This categorises antibiotics into three categories – Access, Watch and Reserve. The goal is to reduce use of watch and reserve antibiotics in order to reduce the spread of resistant organisms (World Health Organization, 2020). The UK is aiming for a 10% reduction in drugs in the 'reserve' and 'watch' category by 2024.

Despite these campaigns and an increased focus on antibiotic stewardship, antimicrobial resistance is on the rise in the UK – the most recent data show a 32% increase in the incidence of antibiotic-resistant bloodstream infections – from 13 671 in 2015 to 18 110 in 2019 (Figure 1) (Public Health England, 2020). The COVID-19 pandemic could accelerate this already worrying trend, as a result of antibiotic overprescription for those without true bacterial infections as well as misunderstandings among clinicians and the public about the effect of antibiotics on those with COVID-19 (Arshad et al, 2020). As antimicrobial resistance increases, the importance of antibiotic stewardship becomes ever clearer.

The use of antibiotics in UK surgical departments

Antibiotics are used within the inpatient surgical setting in two main ways: preoperative prophylaxis and the treatment of acute surgical pathologies.

Surgical antibiotic prophylaxis

The use of antibiotic prophylaxis in surgery dates back to the introduction of antibiotic agents, namely penicillin, in the mid-20th century. Early studies showed antibiotic prophylaxis

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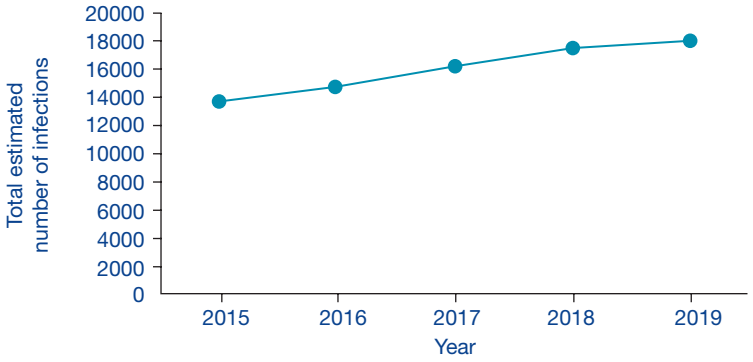

Figure 1. Total incidence of antibiotic-resistant bloodstream infections in England from 2015 to 2019 (Public Health England, 2020).

reduced the rate of wound infection in abdominal surgery by 15%, and this was widely adopted by all surgical specialties. Initial use was haphazard, with no particular guidelines or criteria to guide surgeons about which agents to use for which procedures (Westerman, 1984).

An increasing evidence base has led to the production of guidelines for antibiotic prophylaxis from a number of organisations. In the UK, the National Institute for Health and Care Excellence (2020) has released guidelines on the prevention of surgical site infections. They advise using antibiotic prophylaxis in patients undergoing clean surgery involving prosthesis, clean-contaminated surgery and contaminated surgery, and advise against routine antibiotic prophylaxis for clean non-prosthetic surgery. Specific agents are not discussed, but they recommend using the local antibiotic formulary in deciding which agent to administer.

Research on the efficacy of antibiotic prophylaxis in reducing the rate of surgical site infections is ongoing. A systematic review found that the use of antibiotic prophylaxis in hernia repair with mesh had little effect on postoperative wound infection rates, despite this being a clean surgery involving a prosthetic (Orelio et al, 2020).

Antibiotics in the management of acute surgical pathologies

There is a wide range of acute surgical conditions which require administration of antibiotics. Antibiotics are used in surgery for cholecystitis, appendicitis and diverticulitis, three of the six most common general surgical presentations in the UK (Ramsay et al, 2018). There are guidelines for antibiotic use in these conditions at both national and local level. For example, National Institute for Health and Care Excellence (2019) guidance on the management of acute diverticulitis advises co-amoxiclav as first-line antibiotic in cases of diverticulitis, but with advice to consider a no antibiotic prescribing strategy if the patient is systemically well. Guidelines for the majority of surgical conditions are local, with NHS trusts producing antimicrobial guidelines based on local bacteria prevalence and sensitivity data, as well as local prescribing practices.

Complexities of antibiotic use in surgical patients

The management of surgical patients can vary significantly to that of medical patients. Often, patients are nil by mouth for extended periods of time, for example in conditions such as bowel obstruction (Griffiths and Glancy, 2020). In patients able to take oral antibiotics, absorption might be impacted by gastrointestinal conditions, especially in patients who have undergone surgical resection (Titus et al, 2013). These factors can impact the ability to switch from intravenous to oral antibiotics within 48 hours, as is often advised in antimicrobial stewardship programmes. Surgical infections can often be complex and may require extended courses of antibiotics. One study found that, in patients with surgical site infections, nearly 10% had a bacteraemia, predominantly *Staphylococcus aureus* (Petti et al, 2002). The diagnosis of *S. aureus* bacteraemia requires treatment with extended courses of intravenous antibiotics of up to 6 weeks, which may not be covered by local guidelines (Holland et al, 2014). However, antimicrobial stewardship programmes still play an important role in the management of surgical infections, and there are a number of ways in which their use could be improved within surgical departments.

Current challenges: antibiotic prescribing in surgical departments

Antibiotic prescribing within surgical departments, both in prescription of antibiotic prophylaxis and in management of surgical inpatients, faces clear challenges. Several studies have revealed poor adherence to guidelines for surgical antibiotic prophylaxis, with one finding only 57% compliance in a UK surgical department (McGrath et al, 2014), and another finding antibiotic prophylaxis guidelines were followed in just 31% of gastrointestinal operations in a UK hospital (Cameron et al, 2015).

A prospective cohort study in a single centre in the UK compared inpatient antibiotic prescribing in surgical and medical specialities (Charani et al, 2019b). They found that 55% of patients admitted under the emergency general surgical team received antibiotics during their admission, a greater proportion than the medical team. A lower proportion of surgical patients were prescribed antibiotics in accordance with local guidelines compared to patients admitted under the medical team (65% vs 80%, $P<0.001$), with fewer patients having their antibiotic prescriptions reviewed during morning ward rounds. General surgery doctors have been found to have poor concordance with guidance for intravenous to oral stepdown of antibiotics, with 40% of patients remaining on intravenous antibiotics despite fulfilling the criteria for oral switch (Rizan et al, 2017). A global survey of practising emergency surgeons highlighted similar concerns – one in four surgeons did not refer to local guidelines, instead relying on personal knowledge and experience to inform decisions on antibiotic prescribing (Labricciosa et al, 2018).

The reason for issues in prescribing antibiotics in surgical departments appears to be multifactorial. Surgical teams often work within highly pressurised environments, where senior staff have multiple responsibilities including wards, clinics and theatres. This can lead to time-pressured ward rounds during which issues of antibiotic stewardship, such as ensuring patients are being treated as per local guidelines, are missed (Charani et al, 2017).

Perceived risk of blame also factors into antibiotic prescribing decisions within surgical teams. Analysis of the experience of junior doctors working within surgical teams has found that there is a fear of withholding or de-escalating antibiotics – this can lead to doctors 'erring on the side of caution' and prescribing antibiotics even when not clinically indicated (Kajamaa et al, 2019). This fear of negative outcomes is reported to be greater in surgical teams than in medical teams, with more frequent deferral of the decision to de-escalate antibiotic therapy (Charani et al, 2019a).

Leadership and hierarchy are frequently discussed in analysis of antibiotic prescribing practices in surgical departments. The decision maker in the surgical team often varies because of the multiple commitments of surgical consultants and senior trainees. As a result, antibiotic prescribing decisions can be delegated to junior members of staff, with adherence to guidelines low down on their priority list (Charani et al, 2017). Conversely, the hierarchy within surgery means more junior members of staff can have difficulty questioning the decision making of more senior doctors. This can lead to doctors prescribing medications against their better judgement, and against available guidelines (Lewis and Tully, 2009). Lack of adherence to these guidelines is justified by some clinicians, who emphasise the importance of experience of senior clinicians, and the perceived need to individualise antibiotic therapy for each patient (Charani et al, 2013).

Lack of clear responsibility for decisions surrounding antibiotic prescription can also lead to confusion, particularly on the part of trainee doctors. Differences of opinion between consultant surgeons and microbiologists are frequently cited, with a lack of discussion of decision-making steps in antibiotic prescribing leading to confusion in junior team members and a resultant reduction in quality of antibiotic prescription (Mattick et al, 2014).

Improving antibiotic stewardship in surgical departments

The challenges discussed are wide ranging. However, evidence has shown that there are ways to improve antibiotic stewardship within hospitals and surgical departments more specifically.

First, education. The quality of teaching on antibiotic stewardship is variable, with only 69% of UK medical schools including teaching on all recommended principles (Castro-Sánchez et al, 2016). Efforts have been made to standardise teaching on antibiotic stewardship within universities, through the production of consensus-based competency descriptors, with the aim of helping universities to develop curricula and ensure a standardised level of teaching on antibiotic stewardship within UK medical schools (McMaster et al, 2020).

Second, a wide range of interventions within hospitals have been found to improve adherence to antibiotic stewardship guidelines. A systematic review analysed the impact of enabling and restrictive interventions on antibiotic prescribing within hospitals (Davey et al, 2017). Enabling interventions include audit and feedback, decision support software and educational outreach. Restrictive interventions include limiting access to particular antibiotics in order to increase adherence to local guidelines. The meta-analysis of the included studies found that interventions led to a 15% increase in patients receiving appropriate antibiotic treatment, a reduction in length of stay of 1 day and a reduction in overall duration of antibiotic therapy. These improvements in antibiotic stewardship were seen in both enablement and restrictive interventions, suggesting that a range of strategies can be effective in improving the quality of antibiotic prescribing in inpatient settings. A specific intervention that is effective in improving stewardship in surgical teams is increasing the availability of reports on local rates of antimicrobial resistance. Surgeons who received these reports had an increased awareness of local antimicrobial resistance issues, were more likely to adhere to local antibiotic guidelines, and were also more likely to consider hand hygiene and infection control practices as effective preventative measures (Labricciosa et al, 2018).

Involving a range of professionals in local antibiotic stewardship groups is crucial. Antibiotic pharmacists working in hospitals have been found to improve adherence to guidelines, and can help with the implementation of enabling and restrictive interventions to target adherence to antimicrobial guidelines (Hand, 2007). However, as well as the consultant microbiologist and antibiotic pharmacists who usually form local antibiotic stewardship groups, there needs to be involvement from all specialties involved in antibiotic prescribing. Involvement of surgeons in these programmes can ensure that progress is audited and improve integration of best practices into the surgical team (Sartelli et al, 2017). Auditing antibiotic prescribing, providing feedback to prescribers and implementing electronic prescribing can all be assisted by the involvement of surgeons in the antibiotic stewardship programmes – all of these interventions have been found to be effective in improving adherence to guidelines (Davey et al, 2017).

Conclusions

The urgent need for improved antibiotic stewardship is clearer than ever, and research continues to document the ways in which surgical departments can and must play their part. Education, enabling and restrictive interventions all play a role in improving antibiotic stewardship within hospital surgical teams – this must take into account the particular complexities in managing antibiotics in surgical patients, including the increased likelihood of patients being nil by mouth and the need for extended treatment in complex surgical infections.

However, with a wide range of possible actions and diffuse responsibilities, effective action will need to be systematic and inclusive. For surgical departments, where many challenges relate to culture and hierarchy, this will mean enacting solutions that support appropriate antibiotic use at all levels of leadership and across the multidisciplinary surgical team. Ensuring engagement of junior and senior members of the surgical team with antibiotic stewardship programmes is likely to be crucial in ensuring their success.

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Key points

- Antibiotics are widely used in the management of surgical patients, as both preoperative prophylaxis and in the treatment of acute surgical conditions. This can be complicated by patients being kept nil by mouth and the potential poor absorption of oral antibiotics after gastrointestinal procedures.
- The increasing threat of antimicrobial resistance makes antibiotic stewardship ever more important.
- Antibiotic stewardship is often poor within surgical teams, with poor adherence to guidance on preoperative prophylaxis and use of antibiotics in inpatients.
- Issues affecting compliance with guidelines include time pressure, perceived risk of blame and the impact of leadership and hierarchy on prescribing practices.
- There is a range of interventions that have been shown to be effective in improving antibiotic stewardship, which surgical departments should consider.
- Changing practice within surgical teams will take a wide-ranging approach, which engages surgeons at all levels with antibiotic stewardship programmes.

Conflicts of interest
The authors declare that there are no conflicts of interest.

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