Antibiotic Prophylaxis in Surgery

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One of the more dramatic effects of antimicrobial chemotherapy has been its influence on the practice of modern surgery. The use of perioperative antibiotic prophylaxis has been shown to prevent post-surgical wound and other infections. When employed rationally, significant reductions in morbidity and mortality as well as savings in resources can be clearly demonstrated. However, when used excessively in conditions where its benefit has not been established, negative effects like unjustifiably high costs of medical care and the emergence of bacterial resistance can occur.

The benefits of antimicrobial prophylaxis were first demonstrated in animal experiments. Miles in the mid-1950s showed that streptomycin protected against pseudomonal dermal infections in animals if the antibiotic was given within 3 hours of the bacterial inoculation. Miles referred to this crucial interval as the decisive period. Burke, several years later, showed quite conclusively that administration of penicillin in guinea-pigs inoculated intradermally with Staphylococcus aureus prevented infection if the penicillin was given shortly before or after the inoculation of the bacteria. If the administration of penicillin was delayed more than 3-4 hours after bacterial inoculation, the prophylactic effect was lost. This decisive period probably represents the time required by the bacteria to establish an infection. Once an infection is established prophylactic antibiotics become useless. The significance of this important principle in the clinical setting was demonstrated by Classen et al some thirty years later. Classen prospectively monitored 2847 patients undergoing elective clean-contaminated and contaminated procedures. Of the 1708 patients who received antibiotics during the two hours prior to incision, the infection rate was 0.6%. This contrasted with an infection rate of 1.4% in 282 patients who received antibiotics in the 3 hours after incision and 3.3% infection rate in 488 patients who only received antibiotics 3 hours or more after incision. Statistical analysis of these results confirmed that administration of antibiotics in the 2 hours before surgery was associated with the lowest risk of infection. The timing of antibiotic administration is therefore crucial and a single pre-operative dose given at time of induction of anaesthesia is sufficient in most cases. Where operations are prolonged a second intra-operative dose may be necessary.

While the value of antibiotic prophylaxis in clean-contaminated and contaminated operations is quite clear, the use of such prophylaxis in clean surgery remains controversial. Platt et al assessed the efficacy of antibiotic prophylaxis in 1218 patients undergoing herniorrhaphy and breast surgery. Patients who received prophylaxis had 48% fewer probable or definite infections compared to those who did not. However, if only definite infections were taken into account the difference in infection rates was not statistically significant. Proponents of antibiotic prophylaxis for clean surgery point out that the true rates of septic complications following such operations may have been grossly underestimated. This is because many infectious complications may develop only after patients are discharged and may not have been recorded. This was demonstrated in a study conducted in Southampton involving 560 herniorrhaphy patients. In this study each patient was closely monitored by trained surgical nurses in the community after discharge from hospital. Using such aggressive surveillance methods an infection rate of 13.2% was recorded. This is much higher than the oft quoted rate of below 5% for herniorrhaphy.

In this issue of the journal, Huam et al reports on their experience with antibiotic prophylaxis in women undergoing elective Caesarean section in a Malaysian teaching hospital. While the value of prophylactic antibiotics in emergency Caesarean operations is well
established, its use in elective, low-risk operations is less clear. There has been conflicting reports on this matter. Nice et al studied 4076 women undergoing delivery in five West Yorkshire maternity units. They found a Caesarean rate of 15.4%. The overall infection rate following Caesarean section was 7.2% (ranging from 2.5 - 17.2%). The infection rate when antibiotic prophylaxis was used was 6.2% compared to 7.7% without antibiotics; the difference being not statistically significant. They concluded that antibiotic prophylaxis be limited to selected women at high risk. In another study from Australia involving 428 patients undergoing Caesarean section, a wound infection rate of 25% was recorded. Interestingly over a third of these infections occurred after discharge. Antibiotic prophylaxis was found to be the most significant protective factor in the reduction of post-caesarean wound infection. A single prophylactic dose of ampicillin has been shown to reduce the post-caesarean infection rate from 38.2% to 15.2% in rural Uganda. In Huam's study a single prophylactic dose of amoxicillin-clavulanic acid reduced post-operative infectious morbidity from 38% to 19%, a result not too dissimilar to the Ugandan study.

These studies suggest that the value of antibiotic prophylaxis in Caesarean section may depend to some extent on the local circumstances prevailing in the institution practising it. The results obtained from one centre cannot be applied universally and each institution will have to formulate a policy best suited to its needs. However, the cost-benefit of giving routine antibiotic prophylaxis should be carefully analysed and surgeons should always be made aware that antibiotics cannot substitute for poor surgical technique.

References