WOUND INFECTION IN AN ORTHOPAEDIC UNIT

J. G. CAMBLIN, F.R.C.S.,*
Senior Orthopaedic Registrar, Department of Orthopaedics, Musgrave Park Hospital, Belfast

and

DR. E. S. MITCHELL, F.R.C.P.,
Consultant Pathologist, Musgrave Park Hospital, Belfast
* Now Fellow of Orthopaedic Oncology, University of Florida, Gainesville, Florida.

WOUND INFECTION IN AN ORTHOPAEDIC UNIT

RECENTLY, attention has gradually moved away from the quantity and technique of surgical procedures towards the quality of the work. It is in this vein that this study was focused on wound infection following orthopaedic surgery. This has been studied in other centres and the reported incidence has varied from 1.68 per cent (Wilson et al. 1972) to as high as 19.8 per cent when hip arthroplasty alone has been considered (Patterson and Brown 1972; Bingham, Fleenor and Church 1974). Most authors have a reported wound infection rate of 4 to 11 per cent for total hip arthroplasty (Cruess, Bickel and von Kessler 1975, McKee and Watson-Farrar 1966, Bergstrom, Lidgren and Lindberg 1974) and, with the introduction of a laminar air-flow tent, this incidence has been reduced to 3.8 per cent (Charnley 1972, Dupont and Charnley 1972). The main organisms cultured from the wounds in the reported series were Staphlococcus aureus, E. coli and Pseudomonas spp.

This study reports the incidence of wound infection in an orthopaedic unit over a five-year period. The theatre system used by this unit was not equipped with the sophistication of laminar air-flow systems and systematic antibiotic prophylaxis was not a policy of this unit, even in total hip replacement.

PATIENTS AND METHODS

Information regarding the number of patients treated in the orthopaedic unit and the nature of their surgical procedures was obtained from the theatre records. The number of patients whose wounds subsequently became infected during the study period, from 1st January 1970 to 30th April 1975 inclusive, was obtained from the records of the bacteriology laboratory at Musgrave Park Hospital, Belfast. In all cases, the infection was confirmed by a positive swab culture and the isolation of the infecting organism. In addition to the overall infection rate in the unit, that for total hip arthroplasty was recorded separately.

RESULTS

Throughout the study period, there was a total of 14,222 surgical procedures carried out in the orthopaedic unit at Musgrave Park Hospital. During this time, a total of 221 infected wounds were recorded, including those that were already
contaminated prior to surgery. This gave a gross overall sepsis rate of 1.55 per cent. However, this figure is misleading in that dirty or contaminated wounds are included and also it fails to take into consideration the changing pattern of medical care. Excluding the contaminated cases, there were 14,111 clean cases treated by this unit since the start of the study period and, of these, only 127 subsequently became infected. This gave an overall avoidable infection rate of 0.90 per cent.

There has been a steady reduction in the annual infection rate due to a decline in avoidable sepsis (Table 1). In 1970, this was comparable to other centres and stood at 1.29 per cent. The current level of avoidable infection for this unit is now 0.62 per cent. Primarily, as a result of this, the overall gross annual infection rate fell from 1.84 per cent (1970) to the present level of 0.74 per cent for all types of surgical procedures.

**Table 1**

*Yearly Infection Rate for All Types of Orthopaedic Surgery*

| Year | Total cases | Total infected | Clean cases | Avoidable infection |
|------|-------------|----------------|-------------|---------------------|
| 1970 | 2713        | 50 (1.84)      | 2700        | 35 (1.29)           |
| 1971 | 2838        | 53 (1.86)      | 2811        | 25 (0.94)           |
| 1972 | 2834        | 44 (1.55)      | 2815        | 25 (0.94)           |
| 1973 | 2689        | 45 (1.67)      | 2665        | 21 (0.79)           |
| 1974 | 2425        | 19 (0.74)      | 2407        | 15 (0.62)           |
| 1975*| 723         | 10 (1.38)      | 713         | 6 (0.84)            |

* First 4 months only. Numbers in brackets = percentage.

**ARTROPLASTY**

In this unit, total hip arthroplasty only became commonplace in 1969 and over the years this type of operation has increased in frequency. Initially, the Ring or the McKee-Farrar arthroplasty was used but, during 1970, this gave way to the Charnley or the Howse type of total hip replacement. Both the Charnley and the Howse type prosthesis are currently used with equal frequency. The work load of the unit per year regarding this type of surgery and the resulting wound infection rate are shown in Table 2. Of the total of 1,578 such operations, only 39 became

**Table 2**

*Incidence of Infection in Total Hip Arthroplasty*

| Year | 1970 | 1971 | 1972 | 1973 | 1974 | 1975* | Total |
|------|------|------|------|------|------|-------|-------|
| Number | 150  | 318  | 328  | 328  | 352  | 102   | 1578  |
| Infected | 10   | 10   | 4    | 11   | 3    | 1     | 39    |
| Infection rate (percentage) | 6.66 | 3.15 | 1.13 | 3.35 | 0.85 | 0.98 | 2.47 |

* First 4 months only.
infected and thus gave a gross infection rate of 2.47 per cent. The infection rate for the first year of this study was 6.67 per cent and this has been reduced to the present level of 0.85 per cent. This substantial improvement in avoidable sepsis is most encouraging.

This reduction may in part be due to improved technique and also to a change in the type of materials used in the implant. The majority of the hip arthroplasties carried out in 1970 were of the metal-to-metal type and, on the first year of the introduction of the metal-to-plastic arthroplasty systems, the infection rate fell by 50 per cent. It has steadily continued to fall ever since.

Following the success of the hip replacement procedures, a similar approach was considered for arthritis of the knee. Of the many types of such prostheses, the Geomedic and the Marmor prostheses are used in this unit. Although only 30 such implants have been carried out, following their introduction within the last year, it is of interest that none have given rise to any wound infection.

ORGANISMS

On considering the type of organisms concerned, there has been a change in the nature of the infecting agent. In 1970, the majority of wound infections were due to *Staph. aureus* and this organism accounted for 66.6 per cent of cases. During the period of this study, the incidence of this organism has declined so that at present only 46.2 per cent of wound infections were due to this agent. However, during the same period of time, the incidence of Gram negative infections increased from 24 per cent to a current level of 53.9 per cent (Table 3). The majority of the infections in this study were superficial and in almost all cases the organism was sensitive to most common antibiotics.

| Year | Staph. aureus | Gram negative | Others | Total |
|------|---------------|---------------|--------|-------|
| 1970 | 36 (66.67)    | 13 (24.00)    | 5      | 54    |
| 1971 | 42 (70.00)    | 12 (20.00)    | 6      | 60    |
| 1972 | 29 (65.90)    | 12 (27.27)    | 3      | 44    |
| 1973 | 28 (57.14)    | 17 (34.69)    | 4      | 49    |
| 1974 | 10 (55.56)    | 8 (44.44)     | 0      | 18    |
| 1975*| 6 (46.15)     | 7 (53.85)     | 0      | 13    |

* First 4 months only. Numbers in brackets=percentage.

During the first few months of this year, the unit has been forced by lack of nursing staff to use only one theatre. The work load for this single theatre has been increased from 113 cases per month, as it was in the preceeding five years, to the present through-put of 181 cases per month. In view of this increased use, it was thought that there would be an associated increase in wound infection. This has not happened. The infection rate for the first four months of this year is exactly
comparable to the same period of 1974. The nature of the infecting organisms has also remained unaltered. The most frequent infecting agents throughout the entire study period were Staph. aureus, E. coli and B. Proteus. Pseudomonas spp. has only given rise to wound infections since 1973 and is increasing in frequency.

COMMENT

The incidence of wound infection following orthopaedic surgery has decreased over the study period from 1970 till 1975, mainly due to a reduction in avoidable sepsis. This incidence now stands at 0.62 per cent for all types of surgical procedures. That following total hip arthroplasty has fallen from 6.66 per cent to the present level of 0.85 per cent. Charnley (1972) reports an infection rate of 2.2 per cent following such surgery. In comparison, these results are very encouraging since the theatres in this unit are not fitted with laminar air-flow tents, as used by Carnley in his unit.

It has been suggested that wound infection may be reduced by local antibiotic application in the form of wound irrigation using an antibiotic solution. This has been reported to reduce avoidable wound sepsis to 0.5 per cent (Bingham et al. 1974). It was not the policy of this unit to use antibiotic cover either as an irrigation or systemically unless there was a specific indication for such antibiotic cover. A policy calling for the liberal use of antibiotics could lead to the introduction of resistant organisms which have not been encountered in this unit. The difference between 0.62 per cent in this unit and 0.5 per cent (Bingham, Fleenor and Church 1974) does not seem to warrant such a policy and its attendant risks.

There is at present a proposal to build a new theatre suite for the orthopaedic unit. Each theatre would be provided with a laminar air-flow tent, as used by Charnley and others. If used with current surgical techniques, this should reduce still further the incidence of wound infection, especially following prosthetic implants. There is, unfortunately, a chance that, with the introduction of such a system, attention to detail may not be as strict as at present and thus the end result would be less than satisfactory and not demonstrate the true worth of this improved system.

SUMMARY

In one orthopaedic unit not equipped with laminar air-flow systems a total of 14,222 operations was carried out during the period 1970—April 1975 with an overall avoidable wound infection rate of only 0.90 per cent. The current level for all types of surgery in this unit is now only 0.62 per cent. and compares favourably with other centres. With regard to total hip arthroplasty the infection rate has fallen from 6.66 per cent in 1970 when metal-metal prostheses were used to the present level of 0.85 per cent since the introduction of metal-plastic Charnley or Howse type hip replacements.

The changing pattern of infection from the Gram positive Staph. aureus to the Gram negative E. coli and B. proteus which now accounts for 45 per cent of wound infection is described. The lack of resistant strains of organisms in this unit in the absence of an antibiotic-cover policy is noted.
ACKNOWLEDGEMENTS

I should like to thank the Staff of the Orthopaedic Unit, Musgrave Park Hospital, Belfast, for their help and co-operation.

REFERENCES

BERGSTROM, B., LINDGREN, L. and LINDBERG, L. (1974). Clinical Orthopaedics, 99, 95.
BINGHAM, R., FLEENOR, W. H. and CHURCH, S. (1974). Clinical Orthopaedics, 99, 194.
CHARNLEY, J. (1972). Journal of Bone and Joint Surgery, 54B, 61.
CRUESS, R. L., BICKEL, W. S. and VON KESSEL, K. L. C. (1975). Clinical Orthopaedics, 106, 99.
DUPONT, J. A. and CHARNLEY, J. (1972). Journal of Bone and Joint Surgery, 54B, 77.
MCKEE, G. K. and WATSON-FARRAR, J. (1966). Journal of Bone and Joint Surgery, 48B, 245.
PATTERSON, F. P. and BROWN, C. S. (1972). Journal of Bone and Joint Surgery, 54A, 257.
WILSON, P. D., AMSTUTZ, H. C., CZERNECKI, A., SALVATI, E. A. and MENDES, D. G. (1972).
Journal of Bone and Joint Surgery, 54A, 205.