

Changing knives a wasteful and unnecessary ritual

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Summary

The use of two knives for making a surgical incision is a deeply ingrained practice of British surgery and a postal survey of the theatre superintendents in the South-West Thames Region revealed that out of 143 surgeons all but one use this technique. Therefore we undertook a bacteriological study of the knife blades used on a general surgical unit. This showed that under normal conditions pathogenic organisms do not contaminate the knife blade and are not carried into the wound by it. The use of only one knife to make an incision does not increase the incidence of wound infection. A survey of the world literature confirms these findings. The wasteful and unnecessary ritual of using two knives to make an incision through normal skin has no theoretical, scientific or clinical basis and can be discontinued.

Introduction

It is part of the hallowed tradition of British surgical practice that the scalpel blade used for the skin incision is discarded and replaced by a new blade for deeper dissection. This is done to prevent bacteria which may be on the skin from being carried into the deeper layers of the wound and was originally based on studies done many years ago (1,2). Recent studies on the bacteriology of the skin (3,4,5), on the bacterial contamination of the surgical knife (6,7) and on the subsequent development of wound infection if only one knife were used (8) have shown that there is no clinical or bacteriological evidence to support this idea. We therefore carried out a brief survey of the surgical practice in the South-West Thames Region and in the light of this have done a bacteriological and clinical study of this technique as used on a general surgical unit. The literature has been surveyed and this paper is intended as the final comment on the subject.

Method

A questionnaire was sent to the superintendents of theatres at the teaching and district general hospitals in the South-West Thames Region requesting information as to the normal

practice of the consultants in orthopaedic, gynaecological and general surgery with regard to their technique in making incisions. Replies were received through the post.

THE BACTERIOLOGY OF SURGICAL KNIVES

Patients undergoing a variety of elective general surgical operations were included in this study. These operations all fell into the classification of 'clean' or 'clean-contaminated' (9). That is the incision was made through apparently normal skin. On the day of surgery the patients took a shower using 4% chlorhexidine as the cleansing agent and where necessary the operation site was shaved with a razor just before the premedication was given. In the operating theatre the relevant skin was cleaned with 0.5% chlorhexidine in 70% isopropyl alcohol using two separate sponges. The outside knife was used to incise the skin only, the blade was then removed by the instrument nurse using a pair of sterile artery forceps. Each side of that blade was then pressed firmly onto a specially cut blood agar plate (Fig) and then discarded. The inside blade was similarly treated after use.

A further small cohort of patients was then operated on using a single knife blade for both the superficial and deep parts of the wound and cultures were taken from this blade as described.

A wound was defined as infected if it discharged pus (9). Wounds were inspected periodically while the patients were in the ward and each patient was questioned at his follow-up appointment approximately one month after leaving hospital.

Yet another small group of studies was made to test the efficacy of our bacteriological technique by culturing a series of knife blades which had been used to cut bowel at operation.

Bacteriological technique. Layered blood agar plates were prepared using Sterilin plates, Oxoid Columbia agar as a base and Columbia agar with 5% horse blood as a top layer. This agar was poured to give a final depth of 12mm. Plates were then dissected using a sterile scalpel under laminar flow to a preset template (Fig) and then stored at 4°C until use. Following inoculation as already described the plates were incubated aerobically at 37°C for 18 hours, the cultures were

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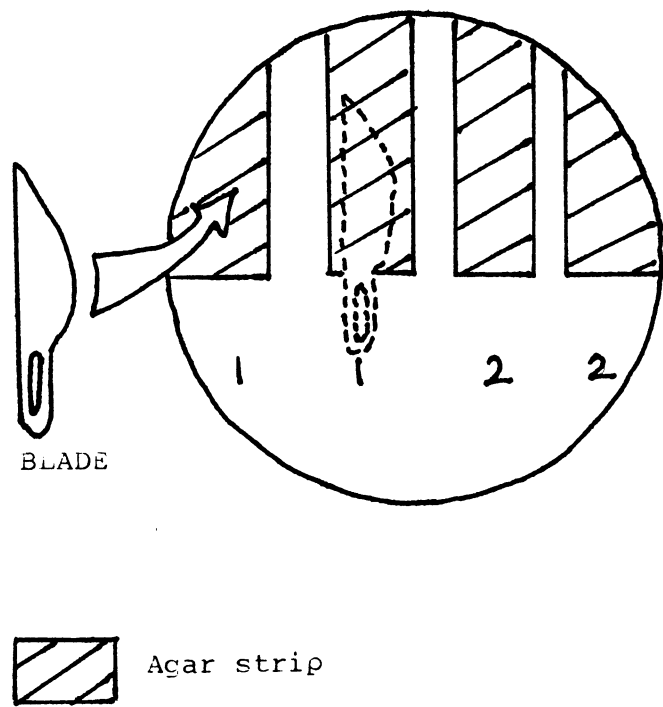


FIG. Diagrammatic representation of blood agar plate used to culture knife blades.

then read and the number of colonies recorded. These colonies were identified to species level only. Anaerobic cultures were not made.

Results

Regional survey of surgical practice

The questionnaire regarding surgical technique was sent to 14 hospitals in the South-West Thames Region. Replies were received from 13 of them. Analysis of these showed that out of 143 consultants in orthopaedics, gynaecology or general surgery 142 used two blades for each incision. Assuming that the same technique is used by their assistants, and this is usually determined by the theatre staff, then a very large number of operations in this Region are conducted in this manner and presumably these findings apply to the whole of the United Kingdom.

Bacteriological study of outside and inside knife blades

93 pairs of knife blades were studied of which a total of 22 blades cultured organisms from 19 patients (Table). The outside blade alone showed contamination in 8 patients, the inside blade in 8 patients and in 3 patients both blades cultured organisms. The general pattern was that only a few colonies were grown from each blade and these organisms were not pathogenic in nature although the occasional pathogen was grown and also considerable numbers of colonies of *Staphylococcus epidermidis* were cultured from two patients.

A wound infection occurred in one of the nineteen patients but the organism (*Escherichia coli*) was not cultured from either knife used for the incision and was presumably acquired from the patients bowel which was opened during the operation.

Bacteriological studies of a single knife blade

In five patients only one knife blade was used for both the superficial and deep parts of the incision. Four of these blades did not grow any organisms but that used in the fifth patient cultured *Staphylococcus epidermidis* from both sides of the blade. None of these patients developed a wound infection.

TABLE Results of the bacteriology of the 19 patients with positive cultures

Operation	Number and type of colonies cultured Knife 1	Knife 2
Abdomino-perineal resection*	1 unspecified	
Anterior resection of rectum	2 <i>S. epidermidis</i>	
Axillary dissection	1 <i>S. aureus</i>	
Breast lump	7 diptheroids	1 coliform 2 <i>S. epidermidis</i>
Cholecystectomy	2 <i>S. epidermidis</i>	1 <i>S. epidermidis</i> 1 faecal streptococci 2 <i>S. epidermidis</i>
Cholecystectomy	24 <i>S. epidermidis</i>	
Cholecystectomy	2 <i>B. subtilis</i>	
Cholecystectomy	1 <i>B. subtilis</i>	
Cholecystectomy		1 <i>S. epidermidis</i>
Hernia		1 <i>S. aureus</i>
Hernia		2 <i>S. aureus</i>
Hernia	7 <i>S. epidermidis</i>	
Hernia		2 unspecified
Laparotomy		6 <i>S. epidermidis</i>
Orchidectomy	47 <i>S. epidermidis</i>	11 <i>S. epidermidis</i>
Orchidopexy	1 <i>S. epidermidis</i>	
Pyeloplasty		1 <i>S. epidermidis</i>
Sigmoid colectomy		6 coliform

* Wound infected *Escherichia coli*.

Bacteriological study of knife blades used to cut bowel

A total of six blades which had been used to cut bowel were cultured. All grew large numbers of colonies of faecal organisms, mainly coliforms.

Discussion

Despite major advances in surgery over the last century wound infection still remains a problem (10). Although seldom a cause of death, wound sepsis frequently leads to an increased morbidity and a prolonged hospital stay after an otherwise uncomplicated operation with the inevitable financial consequences (11). Contamination of a surgical wound may occur either in the operating theatre or in the ward (12) but the factors which determine whether an infection develops are so numerous and variable as to require a computer for their analysis (13). Bacterial contamination of the wound during operation was found to be the most important factor in determining the ultimate behaviour of that wound (12). It follows that the most important factor in controlling surgical wound infection is a meticulous surgical technique (14) part of which has traditionally been to discard the knife used to incise the skin and to use a new blade for deeper dissection. This practice grew out of studies done many years ago (1, 2) which isolated micro-organisms from sweat and surgically prepared skin, and is still maintained to this day in spite of repeated scientific evidence that normal skin is self-cleansing and is only exceptionally colonised by pathogenic organisms (5, 15). The only bacteria cultured in the original studies were the benign "white staphylococci" and since those early days repeated investigations have failed to show that normal skin harbours pathogenic organisms (3).

The bacteria of the skin fall into two main groups: the transient, which may include any organism that comes into contact with the skin and the resident, which usually includes *Staphylococcus epidermidis*. It is thought that other organisms may become temporary residents after prolonged contact (4). Most of the transient organisms are quite superficial and can be removed by mechanical and chemical cleansing, the resident bacteria are situated so deep in the hair follicles and sebaceous glands that they cannot be

removed by mechanical means without injuring the skin and the commonly used anti-septics do not penetrate sufficiently to reach the organisms located in the deeper parts of these structures. However under normal conditions the lower layers of the skin do not harbour pathogenic micro-organisms (3) probably because of the "self-sterilising" properties the skin possesses (5).

The anaerobic flora of the skin far outnumber the aerobic and is found mainly in the sebaceous glands (16) but these bacteria are not pathogenic and are not responsible for the infection of wounds incised through normal skin (17,8). It has not been possible to culture anaerobic organisms from either the surgical knives or the wounds of clean operation cases (6,8) and therefore we did not make anaerobic cultures in this study. If anaerobic bacteria cause infection of a wound made through normal skin they were probably not brought into the wound by the skin knife.

With an understanding of the bacteriology of normal skin it is not surprising that studies have failed to show any benefit from the use of two knives to make an incision. Jacobs first pointed this out in 1974 in a study of the bacteriology of both of the scalpel blades and the wounds in 31 patients. All blades and cultures were consistently sterile except for one patient in whom all three cultures were positive for *staphylococcus epidermidis*. He strongly recommended that the practice of discarding the skin knife should cease (6). More recently some orthopaedic surgeons have, after failing to demonstrate any difference in the bacterial growth between the outside and inside knives in 187 operations, gone so far as to subtitle their paper "A Surgical Myth". They could not find any bacteriological evidence to justify the use of a separate blade for deep dissection in elective orthopaedic practice (7).

The crucial question is whether the use of one knife instead of two increases the risk of wound infection and this was looked at in a randomised controlled trial involving 609 patients. The rate of postoperative wound infection was not significantly different following the use of either one or two scalpels and it was confirmed that the use of two scalpels could be abandoned without increasing the incidence of infected wounds (8).

From our postal survey of hospitals in the South-West Thames Region it is apparent that in spite of convincing bacteriological and clinical evidence to the contrary the vast majority of surgeons and presumably their juniors continue the traditional practice of using two knives for each incision. Our study has confirmed that the skin knife is not responsible for introducing infection through normal skin and that the use of a single knife is safe practice. Organisms were cultured from one or other of the blades used in 19 out of 93 patients but only one of these patients developed a wound infection and this was due to an endogenous organism and was not introduced on a knife blade. These studies were made on a general surgical unit under the usual conditions of a District General Hospital and confirm that the use of two knives for each incision is unnecessary and wasteful.

Cultures taken from knife blades used to cut bowel at operation grew a profuse harvest of organisms, this confirmed the bacteriological technique and also emphasised the importance of discarding instruments which have been used for intestinal anastomoses.

Conclusion

The practice of discarding the knife blade used for incising the skin in a surgical operation and replacing it with a new

blade for deeper dissection is deeply ingrained in the minds of surgeons and theatre nurses. A review of the bacteriology of the skin reveals that theoretically this should be an unnecessary practice and this is confirmed by the lack of significant bacterial contamination of the knives and by the uncomplicated healing of wounds incised by one knife only.

There is now ample bacteriological and clinical evidence that the use of two knives for each incision is not required and even if the economic impact of saving one scalpel blade at each operation is not great some saving can be made. Further studies of this subject would be superfluous and surgeons can confidently cease this practice for incisions through normal skin.

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