ANTERIOR MIDLINE OR MEDIAL PARAPATELLAR INCISION FOR ARTHROPLASTY OF THE KNEE

A COMPARATIVE STUDY

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Early mobilisation after arthroplasty of the knee sometimes results in wound breakdown. The two commonly used incisions, the anterior midline and the medial parapatellar incisions, were compared in order to determine which had the best potential for wound healing.

Study of the cleavage lines around the knee demonstrated that the medial parapatellar incision lies parallel to the lines, whilst the anterior midline incision lies perpendicular to them. In addition, the medial parapatellar wound was found to be subjected to significantly less tension during flexion; after arthroplasty it can be expected to heal faster and to be less liable to disruption during early mobilisation.

Early mobilisation after arthroplasty of the knee includes flexion and extension exercises. Unfortunately this is occasionally followed by wound breakdown and superficial infection which, despite treatment, may progress to a deep infection. This may occur particularly in rheumatoid patients or after insertion of a hinged prosthesis (Johnson and Bannister 1986). Primary wound healing is clearly of paramount importance. The two commonly used incisions for arthroplasty of the knee are the anterior midline incision and the medial parapatellar incision. These incisions were compared to determine which has the better characteristics for wound healing and would be preferable for arthroplasty by allowing early mobilisation with the least chance of wound breakdown.

The orientation of an incision to Langer's lines is known to be important in determining the healing characteristics of a wound. As there is some debate as to their orientation around the knee, it was necessary to map them accurately. The incisions were also compared in order to determine which was less liable to disruption during knee flexion; this was done by measuring the tension across the incisions throughout the range of flexion.

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0301-620X/86/5150 \$2.00

METHODS

The skin overlying the knee of six post-mortem specimens was excised. A 2 mm diameter pin was used to penetrate the skin, making multiple holes about 3 mm apart. After removal of the pin the alignment of the resulting slit was noted. The patterns found were combined into a diagram of the cleavage lines around the knee.

In six other post-mortem specimens an anterior midline incision was made in one knee and a medial parapatellar incision in the other. The skin tension generated during knee flexion was measured using a tensiometer. The tensiometer described by Sandblom, Petersen and Muren (1953) was unsuitable; therefore a simple tensiometer was designed using two steel footplates which were glued to the skin either side of the incision. The footplates were connected to a Mecmesin force dial able to measure up to one kilogram force (9.8 N). The tensiometer was applied either side of an incision and the tension across the wound was measured while the knee was progressively flexed at 10° intervals from extension to 110° of flexion. The results were subjected to statistical evaluation using the chi-squared test.

RESULTS

The pattern of cleavage lines found differed from that reported by previous authors (Figs 1 and 2). The oblique lines found above the knee on the thigh continued down around the sides of the knee before converging below it. A circular pattern was found around the patella. A zone of skin over the anterior aspect of the knee at the level of the femoro-tibial joint line was found to contain a chaotic and inconsistent pattern of lines.

Anterior and posterior views of the right knee showing the pattern of cleavage lines found. The shaded area represents the area of chaotic inconsistent orientation.

Fig. 2

DISCUSSION

Primary wound healing is of paramount importance after arthroplasty of the knee. Mobilisation is undertaken early in the postoperative course in order to attain a good range of flexion without the need for manipulation, and to reduce the incidence of venous thrombosis. If mobilisation is undertaken before the wound is soundly healed, it may slow down wound healing or the wound may be disrupted. Subsequent superficial wound infection may occur which can progress to a deep infection. This method of progression of infection has been found to account for at least 28% of deep infections after knee arthroplasty (Johnson and Bannister 1986).

The two common incisions for knee arthroplasty are the anterior midline incision and the medial parapatellar incision. It has recently been suggested that changing from a medial parapatellar incision to an anterior midline incision is associated with a reduction in the incidence of infection (Lettin et al. 1984). No substantiating evidence for this statement was presented, nor

Fig. 3

Graph of wound tension generated at each 10° of knee flexion for the six anterior midline and the six medial parapatellar incisions. The mean results and the standard deviations are shown.

The results of the tension measurements across the two incisions are shown in Figure 3. It can be seen that whilst the knee is fully extended or is flexed to 10° the tension is the same across the two incisions. However, during flexion from 10° to 90° the anterior midline incision is subjected to more tension. This tension has a disrupting effect upon the wound. The difference in the tension measured across the two incisions is statistically significant ($p < 0.05$).

could any be found by these authors in the medical literature. Our post-mortem study was undertaken to determine which incision is less likely to be disrupted during early mobilisation.

Cleavage lines were first described by Dupuytren in 1834. Langer, in his monumental work written 27 years later, disagreed with some of Dupuytren's findings. Cox wrote a thesis upon skin cleavage lines which again disagreed with some of the previous patterns (Cox 1941).

One of the areas of greatest disagreement has been around the knee. The importance of the cleavage lines lies in the influence that they have long been known to have upon wound healing: incisions made parallel to the cleavage lines heal faster, gain strength faster and result in a neater scar (Ksander, Vistnes and Rose 1977).

Our study has shown that whilst an anterior midline incision lies perpendicular to the cleavage lines for much of its length, a medial parapatellar incision lies parallel to the lines. In order to help prevent wound breakdown progressing to a deep infection it is helpful to site the skin incision so that it does not lie over the capsular incision. Though it is closer to the capsular incision, the medial parapatellar incision need not lie directly over it (Fig. 4).

Fig. 4

Anterior view of the right knee, showing the medial parapatellar, anterior midline and the capsular incisions.

Successful wound healing requires an adequate blood supply to the wound. The vascular anatomy around the knee suggests that blood flows from the popliteal artery forwards around the knee in the geniculate arteries and smaller cutaneous vessels; these vessels anastomose around the patella. There is no evidence to suggest that the lateral wound edge of a medial parapatellar incision is more anoxic than the lateral wound edge of an anterior midline incision. Nor does the medial parapatellar incision restrict the surgeon, as exposure of the lateral compartment may easily be obtained by careful wound retraction.

Early mobilisation is desirable as soon as the wound is considered to be adequately healed, in order to reduce the incidence of venous thrombosis, to allow the

attainment of knee flexion without the need for manipulation under anaesthesia, and in order to allow early discharge from hospital. Our studies have shown that during the period while the wound is susceptible to disruption, the medial parapatellar incision is subjected to significantly less tension and therefore experiences fewer disruptive forces than an anterior midline incision. **Conclusion.** As compared with the anterior midline incision, the medial parapatellar incision has been shown to be better orientated in relation to the cleavage lines, and to be subjected to less tension during flexion of the knee; the medial parapatellar incision wound is therefore less likely to be disrupted by early mobilisation after arthroplasty.

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