



Above-knee versus below-knee stockings in total knee arthroplasty

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ABSTRACT

INTRODUCTION Graduated compression stockings are frequently used following arthroplasty surgery for deep vein thrombosis (DVT) prophylaxis. There are often strongly held beliefs regarding whether below-knee or above-knee stockings should be used in total knee joint replacement. Many surgeons argue that below-knee stockings are more likely to induce wound complications because of increased swelling above the stocking and the elastic causing localised pressure on the wound.

PATIENTS AND METHODS This study is a prospective comparison of above and below-knee stockings in patients undergoing total knee joint replacement. A total of 50 patients were recruited and studied – 23 patients in the above-knee stocking group and 24 in the below-knee group. Swelling around the knee was measured over the course of an in-patient stay, together with wound complication rates and patients' preference.

RESULTS No statistical difference was found between the groups and no difference in wound complication rates was determined.

CONCLUSIONS Below-knee stockings are safe following total knee replacement and are preferred by patients.

KEYWORDS

Stockings – Compression – Arthroplasty – Knee – Clinical trial

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This study looks at a commonly held belief amongst orthopaedic surgeons, namely that the use of above-knee or below-knee stockings has an impact on the outcome of total knee joint replacement (TKJR). Many surgeons prefer routinely to use above-knee leg stockings in TKJR, as they believe that this reduces wound oedema and promotes wound healing. They also point out that below-knee stockings induce wound complications because the elastic support lies over the distal wound, creating unwanted localised pressure on the wound. Below-knee stockings also increase swelling above the stocking, *i.e.* around the proximal wound.

The issue of above-knee versus below-knee stockings for deep vein thrombosis (DVT) prophylaxis was not specifically looked at and none of the studied patients developed a DVT.

The literature search did not reveal any previous papers relating to the use of below-knee or above-knee stockings in TKJR, except those papers looking at DVT rates.^{1–7} A small number of papers compared below and above-knee stockings.^{1,2,3,7–12}

Our null hypothesis was, therefore, that there would be no difference between the two groups.

Patients and Methods

Our unit routinely uses both above- and below-knee stockings in arthroplasty patients; the senior author's patients all wear above-knee stockings for total knee joint replacement. All other consultants in the department routinely prescribe below-knee stockings. The department agreed that any patients undergoing TKJR could be admitted to the study. Patients had one of two types of prosthesis available in the department and all patients had postoperative drains that were routinely removed prior to 48 h postoperatively.

Stockings are applied pre-operatively and then re-applied postoperatively prior to leaving theatre. All patients are fitted with calf pumps on arriving back on the orthopaedic ward; these are discontinued after 24–48 h once the patient is mobile.

Between October 2002 and May 2003, patients admitted to the unit for total knee joint replacement were asked if they would take part in a trial to ascertain whether either above-knee or below-knee stockings had an advantage over the other. If they agreed to take part, they were allocated to

Patient's Addressograph

Knee to be operated on?	Left or Right	<i>Please delete</i>
Timing of measurement	Right cm	Left cm
Pre-operatively		
Postoperatively day 5		
On day of discharge		

Long leg or Short stockings worn? *Please delete*

Please measure at proximal pole of the patella on both knees




Figure 1 Measurement of swelling in total knee joint replacements. Long-leg graduated compression stockings versus below-knee stockings.

either above- or below-knee stockings based on their date of birth. There were no initial exclusion criteria. Any patient with a history or high risk of DVT was treated prophylactically with low molecular weight heparin.

Patients were recruited and consented for participation by the nurse practitioners working in the orthopaedic department.

All patients born in an even year were assigned to the below-knee stocking group, and those born in an odd year were assigned to the above-knee stocking group.

A proforma was put on the wards to be filled in by the named nurse looking after the patient on the unit. Patients had their knee circumference measured pre-operatively on the day of admission, at 5 days' postoperatively and at discharge. The circumference was measured by the same individual for each patient and was measured at the proximal pole of the patella as shown in the diagram provided in the proformas on each ward (Fig. 1). This method was chosen for its simplicity. It is non-invasive, simple to do on an early post-operative patient with little discomfort and minimal risk of error as patients are routinely measured for stockings prior to theatre; this measurement is, therefore, a familiar task.

A note of all complications is routinely kept on each ward, and any complications or re-admissions in orthopaedic patients are reported back to our orthopaedic staff by any other admitting ward. This means that only complications treated out of area will have been missed by our reporting system.

The timing of discharge for the TKJR patients depends on them achieving 90° of knee flexion, a dry wound, and to be deemed 'safe' on crutches or Zimmer frame by a physiotherapist. Most patients are discharged between 5 and 10 days, unless social problems intervene.

Comfort was measured subjectively by asking the patients. They were also asked, if given a choice, whether they would change to a different length of stocking.

Results

No patient refused to enter the trial. The first patient enrolled in November 2002 and the last in May 2003.

In all, 50 patients were initially recruited to the study; 2 patients subsequently did not undergo the planned proce-

Table 1 Patient demographics

	Below-knee stockings	Above-knee stockings
M:F ratio	14:10	11:12
Average age (years)	72	70
Left:right ratio (operated side)	10:13	7:17

ture of TKJR. One patient refused to wear any stockings postoperatively; this patient started in the above-knee stocking group. Another patient changed from the above-knee stocking to below-knee stocking group, due to intolerance of the above-knee stockings. Therefore, finally there were 23 patients in the above-knee stocking group and 24 in the below-knee stocking group.

Three patients in the above-knee stocking group and 2 patients in the below-knee stocking group failed to have their knee circumference measured on the day of discharge. There was one leaking wound postoperatively in the above-knee stocking group, which settled prior to discharge from hospital with conservative management. There were no significant complications, DVTs, wound infections, or other local complications by the end of the study in June 2003. Patient demographics are shown in Table 1.

The changes in swelling noted on day 5 and the day of discharge in both the non-operated side and the operated sides are shown in Table 2. These figures were derived by subtracting the measured pre-operative circumference from the postoperative value.

Most patients, particularly female patients, found the above-knee stockings uncomfortable, and all the female patients would have preferred to wear below-knee stockings.

Statistical analysis

The results appeared normally distributed when plotted; however, as the numbers were relatively small, the data

Table 2 Changes in knee circumference after total knee joint replacement

	Operated side		Non-operated side	
	Below	Above	Below	Above
At 5 days				
Mean	4.4	3.9	0.4	-0.7
SD	2.7	2.1	1.8	1.6
On discharge				
Mean	3.4	3.0	0.4	-0.6
SD	2.8	2.8	2.4	3.5

Measurements in centimetres.

was subjected to parametric analysis and also checked with non-parametric methods. Statistical analysis using both parametric and non-parametric testing revealed no statistical difference between the groups for knee swelling in the operated knee ($P = 0.456$ and $P = 0.716$, respectively, using the t -test and Mann-Whitney test) as summarised in Tables 3 and 4.

There was a reduction in swelling in the non-operated knee with the above-knee stockings which just reached statistical significance ($P = 0.039$); however, the clinical relevance of this can be seen by looking at the degree of swelling involved. Table 3 shows that while this test reached significance, the mean difference in change in swelling was only 1.09 cm (with confidence intervals of 0.06–2.16 cm).

Discussion

This study showed no statistically significant difference in swelling between above- and below-knee stockings in the operated knee.

Table 3 t-Test for equality of the means

	<i>P</i> -value	Mean difference	95% confidence interval of the difference	
			Lower	Upper
At 5 days				
Operated side	0.456	0.53	-0.88	1.93
Non-operated	0.039	1.09	0.06	2.12
On discharge				
Operated side	0.627	0.43	-1.35	2.21
Non-operated	0.286	1.01	-0.87	2.88

Table 4 Mann-Whitney test results

		P-value
At 5 days		
	Operated side	0.716
	Non-operated	0.044
On discharge		
	Operated side	0.743
	Non-operated	0.236

This was a surprise as both authors had expected to find considerably more swelling within the below-knee stocking group. We, therefore, accepted the null hypothesis. There does exist because of the small sample size the possibility of a type II error. The data appeared to be normally distributed, the mean differences small, and the *P*-value so high that it seems unlikely that a true difference was missed. Increasing the trial numbers would increase the likelihood of finding a significant difference with a smaller change in swelling. This is unlikely to be of any clinical value as the observed mean difference between below- and above-knee stockings was only 0.6 cm in the operated group. A smaller statistically significant difference would not be of clinical relevance.

As shown in Table 3, the mean difference in swelling was 1 cm with confidence intervals of 0.06–2.16 cm in the non-operated group; this reached statistical significance, but with such a small mean difference in swelling has doubtful clinical significance.

Intra-articular haematoma will also cause an increase in knee circumference. All patients had postoperative drains, and no patient went back to theatre. Therefore, while some change in circumference may be due to intra-articular haematoma, we felt that predominantly most change was due to soft tissue swelling as was evident in the oedematous look to the tissues postoperatively which settled with time.

Increasing the number of enrolled patients might demonstrate a difference in the rate of wound complications. In our study, the only wound problem was in the above-knee stocking group

We attempted to remove observer bias by having nursing staff measure the limbs and complete the relevant proformas, removing the investigator from taking any measurements.

There were no DVTs within the study groups; however, this study is too small to comment on the difference in DVT rates for the two groups.

Conclusions

This simple study shows that for reduction in knee swelling, wound complication rate and comfort, below-knee stockings can be safely used for patients undergoing TKJR.

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