Acta Orthop. Belg., 2009, **75**, 649-653

ORIGINAL STUDY

Cutaneous sensory loss following primary total knee arthroplasty. A two years follow-up study

Sivaraman SUBRAMANIAN, Hakeem LATEEF, Araz MASSRAF

From Edith Cavell Hospital, Peterborough, United Kingdom

We examined 32 patients for skin flap numbness around their scars after primary total knee arthroplasty (TKA). All 32 patients were reviewed six weeks following surgery and two years thereafter. The aims of our study were to determine the natural history of cutaneous sensory loss, to identify the relationship with scar length and scar location, as well as the relationship between the size of the numb area and the severity of numbness and its recovery pattern. We also studied the relationship between numbness and other factors such as tourniquet time, lateral release and patella resurfacing. Twenty-six patients (81%) had lateral skin flap numbness ; the other six patients (19%) had normal skin sensation around the scar. The size of the numb area was large in 19 patients (73%) out of 26. Our findings suggest more severe sensory loss is associated with larger numb area. Patients with a smaller numb area had less severe sensory loss. More laterally placed incisions were having better sensation (p = 0.00435). Patella resurfacing (p = 0.5) and lateral retinacular release (p = 0.10) were not significantly associated with the skin numbness. Fifty percent of our patients fully recovered from skin numbness at the end of two years. Patients with a small numb area had a more favourable outcome compared to those with a larger numb area. We conclude that permanent cutaneous sensory loss is not a universal occurrence following primary TKA ; however a significant number of patients can be affected by this complication. All the patients should be warned about cutaneous numbness before the surgery.

Keywords : primary total knee arthroplasty ; cutaneous sensory loss.

INTRODUCTION

Total knee arthroplasty (TKA) is one of the most successful and cost effective interventions in orthopaedics. According to the National joint registry the number of patients requiring primary TKA is constantly rising : 61 940 knee arthroplasties were done between 2006/2007 in England compared to 61 849 hip arthroplasties for the same period (*7*). Complications such as infection, deep vein thrombosis, pulmonary embolism, aseptic loosening and fractures are very well documented in literature (*2*). These complications are discussed with patients in order to obtain informed consent for operation. Cutaneous sensory loss following TKA is a common problem noticed by both surgeons as well as patients ; occasionally this can cause significant problems to patients (*3*). Only few studies have

■ Sivaraman Subramanian, MBBS, M.S ortho, MRCS, Lower Limb Arthroplasty Fellow.
■ Hakeem Lateef, MBBS, Senior House Officer.
■ Araz Massraf, MBBS, FRCS ortho, Consultant Orthopaedic Surgeon.
Department of Trauma and Orthopaedics, Edith Cavell Hospital, Peterborough, United Kingdom.
Correspondence : Sivaraman Subramanian, Edith Cavell Hospital, Peterborough, PE3 9GX. United Kingdom. E-mail : sivaortho2001@yahoo.co.in

No benefits or funds were received in support of this study

focused on cutaneous sensory loss in patients following TKA.

Borley *et al* (*3*), and Johnson *et al* (*6*) concluded that all patients will have skin numbness following TKA. Hopton *et al* (*5*) found that lateral skin flap numbness is a common problem but not a universal finding after TKA.

This is a prospective study of 32 primary total knee arthroplasties via either an anterior midline or a medial parapatellar incision. The aims of our study were to the determine the natural history of cutaneous sensory loss, to identify the relationship with scar length and scar location, as well as the relationship between size and severity of numbness and its recovery pattern. We have also studied the relationship between numbness and other factors such as tourniquet time, lateral release and patella resurfacing.

PATIENTS AND METHODS

Thirty two patients who had undergone primary total knee arthroplasty were studied. Three different surgeons in three different hospitals performed the operations. All the patients were reviewed by an independent examiner six weeks following surgery and then every year for two years thereafter. The independent examiner conducted interview and completed the proforma after thorough evaluation of the scar and numb area.

The scar was assessed for the following : length in centimeters, scar location in relation to the medial femoral condyle and size of the numb patch (table I). The patients were requested to map out the area of numb patch around their scar with a fine marker pen. This information along with scar length and scar location were then transferred to special transparent 3M wound mapping charts (fig 1).

The numb patch was assessed for the severity of sensory loss using our new scoring system. The new scoring system was evaluated by a consultant neurophysiologist who was working in a different hospital (Charring Cross Hospital, London). Our scoring system consisted of two tests : threshold test and functional test. The threshold test consisted of four components : Pinprick perception (maximum score 3), Temperature perception (maximum score 2), Light touch (maximum score 3), and Vibration sensation (maximum score 3). The functional test consisted of two-point discrimination with pinprick 10mm apart (maximum score 3) and a sweat test (maximum 2). If the patient had normal sensation, then his threshold test score was 11 and his functional test score was 5 (table II).

The numb ratio was calculated by measuring the knee circumference and size of the numb patch. We used the numb ratio to classify the numb patch into large and small numb patch. We have obtained numb ratios for all the patients and calculated the mean. Numb ratio measurements greater than the mean were classified as large numb patches and the measurements less than mean were classified as small numb patches. Other information such as type and duration of anaesthesia, body mass index, known peripheral vascular disease, tourniquet time, patella replacement and lateral retinacular release were noted from the case notes.

RESULTS

The mean age of the patients was 70 years (range 45-88 years). The male/female ratio was 1:7. Twenty six patients had an anterior mid-line incision, 6 patients had a medial parapatellar incision. Twenty-six patients (81%) had lateral skin flap numbness, while the other six (19%) had normal skin sensation around the scar. Nineteen patients (73%) out of 26 had a large numb area. Seven patients (27%) had a small numb area.

The intensity of sensory loss was assessed using our new scoring system. Ten patients out of 26 patients had total numbness (Score : T4F2), the remaining 16 patients had partial numbness. Out of 10 patients with total numbness, 7 patients (70%) had a large numb area whereas only 3 patients (30%) had a small numb area. Our results suggest that a more severe sensory loss is associated with larger numb area. Patients with a smaller numb area had a less severe sensory loss.

The mean length of the scar was 20 cm (range : 15.6-27 cm). Patients with larger numb area had a mean scar length of 21 cm whereas the mean scar length was only 18.5 cm for those who had a small numb area or normal skin sensation. The mean distance from the medial femoral condyle to the scar for the six patients with normal sensation was 10.4 cm, versus 7.17 cm for the 26 patients with numbness. Our results suggest that more laterally placed incisions are associated with better preservation of sensation ($p = 0.00435$).

Table I. — Details of size and location of the TKA scar and numbness area

Patient no	*Scar length*	*Numb ratio*	*Numb size*	*Scar location from Medial Femoral Condyle*
1	18.0 cm	0.302	Large	13.0 cm
2	17.8 cm	0.28	Large	9.5 cm
3	21.0 cm	0.244	Large	10.0 cm
4	25.0 cm	0.241	Large	10.0 cm
5	23.0 cm	0.277	Large	10.0 cm
6	21.0 cm	0.207	Large	9.5 cm
7	25.0 cm	0.200	Large	8.0 cm
8	23.0 cm	0.200	Large	9.0 cm
9	23.0 cm	0.200	Large	8.0 cm
10	22.0 cm	0.176	Large	7.5 cm
11	18.0 cm	0.157	Large	7.0 cm
12	24.0 cm	0.155	Large	9.0 cm
13	17.8 cm	0.154	Large	6.0 cm
14	18.2 cm	0.153	Large	5.5 cm
15	20.3 cm	0.149	Large	7.5 cm
16	23.0 cm	0.148	Large	6.5 cm
17	19.3 cm	0.146	Large	6.0 cm
18	17.5 cm	0.143	Large	4.0 cm
19	20.0 cm	0.139	Large	5.0 cm
20	17.0 cm	0.131	Small	5.0 cm
21	18.0 cm	0.126	Small	5.0 cm
22	16.4 cm	0.111	Small	6.0 cm
23	16.3 cm	0.093	Small	4.5 cm
24	15.6 cm	0.08	Small	4.0 cm
25	16.0 cm	0.06	Small	2.5 cm
26	27.0 cm	0.024	Small	8.5 cm
27	17.3 cm	0.000	Normal	10.0 cm
28	18.4 cm	0.000	Normal	11.0 cm
29	18.6 cm	0.000	Normal	10.0 cm
30	24.0 cm	0.000	Normal	11.5 cm
31	19.1 cm	0.000	Normal	10.0 cm
32	16.8 cm	0.000	Normal	10.0 cm

The tourniquet time had an association with skin numbness. Among patients who had a tourniquet time of more than 2 hours, 78% had skin numbness. Patella resurfacing ($p = 0.5$) and lateral retinacular release ($p = 0.10$) did not have a statistically significant effect on the skin numbness.

All thirty-two patients were reviewed after two years. Six patients with normal skin sensation remained normal. Out of 26 patients with skin numbness, 13 patients (50%) had fully recovered. In 6 patients the size of numb area had reduced after two years. The numbness size remained unchanged in 6 patients and in one patient the numb area had increased after two years. Five out of 7 (71%) of the patients with a small numb area fully recovered from skin numbness, whereas only 8 out of 19 (42%) patients with a large numb area recovered completely from numbness.

DISCUSSION

Total Knee Arthroplasy (TKA) is associated with low morbidity and mortality and its effectiveness in reducing joint pain and improving joint function is well established. Skin numbness after primary TKA can be troublesome to the patient. Many complications of TKA such as infection, thromboembolic disease, neurovascular complications, knee stiffness,

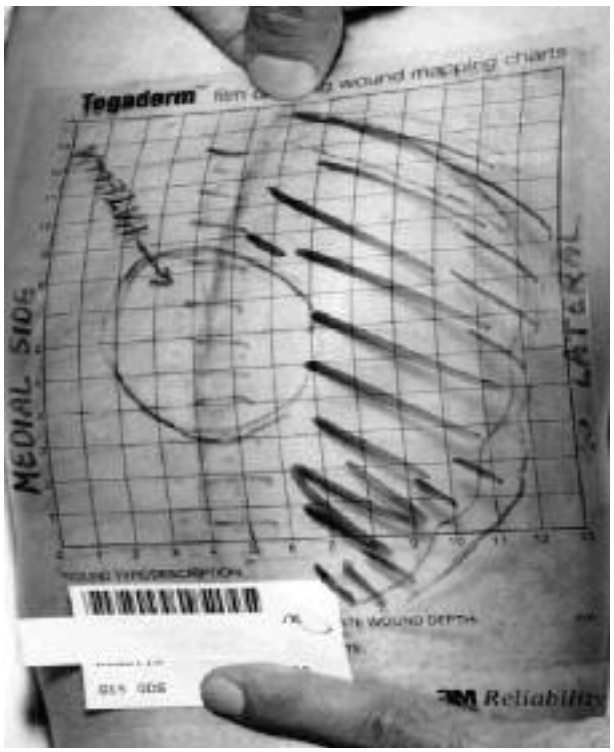

Fig. 1. — 3 M Transparent wound mapping chart

Table II. — The scoring system used in this study

Threshold test (maximum score 11)

1. Pinprick perception :
   Absent = score 1
   Dull = score 2
   Sharp = score 3
2. Temperature perception :
   No feeling = score 1
   Feeling temperature = score 2
3. Light Touch perception :
   Absent = score 1
   Without localisation = score 2
   With localisation = score 3
4. Vibration sensation
   Absent = score 1
   Without localisation = score 2
   With localisation = score 3

Functional test (maximum score 5)

1. Two point discrimination with pinprick 10 mm apart :
   Absent = score 1
   Without localisation = score 2
   With localisation = score 3
2. Sweat test :
   Absent = score 1
   Present = score 2

If threshold score is 11 and functional score is 5 (T11F5), this means NORMAL skin, while T4F2 means totally NUMB skin.

wound complications, fractures and aseptic loosening have been very well documented (*2*) and most of these complications are discussed with the patients in obtaining informed consent for surgery. On the other hand, only three papers have looked at skin numbness in patients following TKA.

To our knowledge the first study to evaluate skin flap numbness following the use of the midline approach for TKA was done by Borley *et al.* They reported that all 25 patients studied had objective skin numbness and only 37% had subjective numbness around the knee. They also found that in seven percent of the patients the numbness was troublesome (*3*).

Johnson *et al* reported that all 35 knees in 26 patients had an area of hypoaesthesia following primary TKA. They also found that a 71% reduction in the size of the area affected was seen over the first two years after surgery and also that all 26 patients had some residual hypoaesthesia at two years (*6*).

Hopton *et al* assessed 113 knees and concluded that not all patients will get lateral skin flap numbness and also that improvement occurs with time. They also did a cadaveric study and found that using a shorter proximal incision preserves branches of the medial and intermediate cutaneous nerves of the thigh and could thus reduce the area of numbness (*5*).

The results from our study show that, not all the patients develop skin numbness following primary TKA. In our study, only 81% had skin numbness. The size of the numb patch also varied : 19 (73%) patients had a large numb area and 7 patients had a small numb area. Ninety two percent of our patients had hypoaesthesia on the lateral side of the scar. We used the numb ratio to classify the numb patch into large and small. We used a new scoring system to

evaluate the intensity of sensory loss immediately after surgery (6 weeks) and at two years after surgery. Our results suggest more severe sensory loss is associated with a larger numb area. Patients with a smaller numb area had less severe sensory loss.

We also found that the size of the numbness directly related to the length of the scar. The scars that were closer to the medial femoral condyle had more numbness than the scars away from the medial femoral condyle. Tourniquet time is also another factor that can contribute to scar numbness : 78% of those patients who had tourniquet time more than two hours, developed skin numbness. Other factors such as patella resurfacing and lateral retinacular release did not have a statistically significant relationship with skin numbness. Fifty percent (13 patients) of our patients with skin numbness recovered at the end of two years follow up ; 71% of patients with a small numb area had complete recovery, whereas only 42% of patients with a large numb recovered fully from numbness at the end of two years.

A longer proximal incision can cause a larger area of numbness due to injury to the main branches of the medial and intermediate cutaneous nerves of the thigh (*1,8*). This injury could be avoided by using a shorter proximal skin incision. Because of the anatomical location of the infra-patellar branch of the saphenous nerve, injury to this nerve is unavoidable, as the incision often extends down to the tibial tuberosity. If injury to the infra-patella branch of the saphenous nerve is inevitable then all the patients should have numbness but some patients escape from numbness. So, there may be other contributing factors (vascular-tissue hypoxia) (*4*) to the numbness in addition to nerve injury or anatomical variations and overlap between the infrapatellar branch of the saphenous nerve and the lateral cutaneous nerve of the calf (*5*).

Transcutaneous oxygen measurements (*4*) both before and after skin incisions around the knee, have demonstrated reduced oxygenation of the lateral skin flap. A medial parapatellar skin incision is associated with a larger lateral skin flap. A larger lateral skin flap has a lower oxygen tension, which can increase the risk of wound complications. This explains why patients with a scar closer to the medial femoral condyle have more numbness than those who have the scar lateral to the medial femoral condyle. The tissue hypoxia theory also explains our finding of prolonged tourniquet time associated with greater numbness.

CONCLUSION

Cutaneous sensory loss is a frequent but not universal occurrence following primary TKA. Its occurrence varies from 86% to 100% following primary TKA. In our study 81% of patients had skin numbness after surgery. All patients should be warned about cutaneous numbness before surgery and this complication should be included in the consent form. We recommend that the surgical skin incision should be away from the medial femoral condyle, if possible slightly lateral to the midline and we also recommend a reduction in the length of the skin incision, especially in its proximal part, as this should decrease the area of numbness following primary TKA. A shorter tourniquet time also has a favourable impact on the skin numbness.

REFERENCES

1. **Agur AMR, Lee MJ.** *Grants Atlas of Anatomy* 9th ed. 1991, Williams & Wilkins, Baltimore.
2. **Ayers DC, Dennis D *et al.*** Common complications of total knee arthroplasty. *J Bone Joint Surg* 1997 ; 79-A : 278-311.
3. **Borley NR, Edwards D, Villar RN.** Lateral skin flap numbness after total knee arthroplasty. *J Arthroplasty* 1995 ; 10 : 13-14.
4. **David P. Johnson.** Midline or parapatellar incision for knee arthroplasty. A comparative study of wound viability. *J Bone Joint Surg* 1988 ; 70-B : 656-658.
5. **Hopton BP, Tommichan MC, Howell FR.** Reducing lateral skin flap numbness after total knee arthroplasty. *Knee* 2004 ; 11 : 289-291.
6. **Johnson DF, Love DTT, Love RT, Lester K.** Dermal hypoesthesia after total knee arthroplasty. *Am J Orthop* 2000 ; 29 : 863-866.
7. *National Joint Registry*, Fourth Annual Report, UK.
8. **Williams PL, Warwick R, Dyson M, Bannister LH.** *Grays Anatomy* 37th ed. 1989, Churchill Livingstone, New York.