Hypesthesia after Anterolateral versus Midline Skin Incision in TKA

A Randomized Study

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Abstract

Background The anterior midline skin incision in a TKA provides excellent surgical exposure. However, it usually requires sectioning the infrapatellar branch of the saphenous nerve which may be associated with lateral cutaneous hypesthesia and neuroma formation.

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

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Each author certifies that his or her institution has approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.

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Questions/purposes We asked whether an anterolateral skin incision to the knee would decrease the area of skin hypesthesia and associated postoperative discomfort.

Patients and Methods We randomized 69 knees to receive a TKA through either a midline or an anterolateral skin incision. We assessed skin sensitivity by application of the Semmes-Weinstein monofilament at 13 reference points at 6 weeks and 6 and 12 months postoperatively. The area of hypesthesia was measured using Mesurim Pro 9[®] software. Patient knee ROM, Knee Injury and Osteoarthritis Outcome Score (KOOS), and WOMAC clinical score also were assessed.

Results The area of hypesthesia was less after an anterolateral compared with a midline incision up to 1 year after surgery: the areas of hypesthesia were, respectively, 32 cm² versus 76 cm² at 6 weeks, 14 cm² versus 29 cm² at 6 months, and 7 cm² versus 19 cm² at 1 year. Clinical scores and knee ROM were similar in both groups at each followup. At 1 year, in the entire group we observed a correlation between a smaller area of paresthesia and better WOMAC and KOOS scores and greater knee flexion.

Conclusions Compared with the midline skin incision, the anterolateral incision is associated with fewer sensory disturbances and appears to be a reasonable alternative in TKA.

Level of Evidence Level I, therapeutic study. See the guidelines for authors for a complete description of levels of evidence.

Introduction

Among the treatment alternatives, TKA is most likely to relieve pain and restore function in patients with severe osteoarthritis and pain in the knees [12, 13]. The function

depends in part on the preoperative scores, surgical technique, and quality of rehabilitation during the early postoperative period [7, 15, 30]. Discomfort during the postoperative period could hinder the rehabilitation process and cause a reduction in knee ROM [37]. Minimizing trauma to the extensor mechanism during arthrotomy may influence pain relief or function. Several surgical options intended to minimize trauma include the midvastus, subvastus, and quadriceps-sparing approaches [2, 6]. However, postoperative pain and dysesthesia arising from cutaneous and subcutaneous tissues also are likely to cause discomfort and affect patient rehabilitation and postoperative clinical scores [5, 39].

A textbook's author advocate placing the skin incision 1 cm medial to the tibial tubercle to facilitate exposure and avoid direct loading of the incision when kneeling [19]. Several retrospective studies with variable followups ranging from 5 weeks to 8 years showed the persistence of an area of hypesthesia at the anterior aspect of the knee in 55% to 100% of patients after TKA using the midline skin incision [8, 16, 20, 41]. This complication may persist for several months or remain permanent after surgery [26, 41, 42]. In approximately one in 10 cases [8, 16, 31], discomfort and pain affecting activities of daily living are reported by patients. These symptoms are caused by trauma induced to the sensory nerves, namely to the infrapatellar branch of the saphenous nerve or its terminal branches, which cross the midline skin incision [42]. To avoid this complication, Müller [35] proposed an anterolateral skin incision, remote from cutaneous sensory branches, followed by a deep subfascial dissection.

We asked whether the anterolateral skin incision in TKA would (1) reduce the area of skin hypesthesia in comparison to a midline incision and (2) influence early knee ROM, WOMAC, and KOOS clinical scores, and local complication rate in comparison to a midline skin incision.

Patients and Methods

Between June 2006 and November 2008, we invited 289 patients 18 years or older who were candidates for primary TKA to participate in the study (Fig. 1). Patients were excluded if they had a history of infection, substantial trauma or surgery on the operative knee, severe comorbidities (cardiac, pulmonary, renal, hematologic) that potentially could complicate the perioperative or postoperative course, lower limb disease other than the osteoarthritic knee that could influence functional results, peripheral or central neurologic impairment, or inflammatory articular disease. We randomized 69 knees in 64 subjects who satisfied our inclusion criteria (Fig. 1) to receive a TKA using an anterolateral (Fig. 2A) or a midline

Fig. 1 The flow chart for our study patients is shown.

skin incision (Fig. 2B) (Supplemental videos are available with the online version of CORR.) The randomization table was made with a random number generator using SPSS® 14.0 (SPSS Inc, Chicago, IL, USA). Three knees required reoperation: in the anterolateral group, one knee had débridements at 4 and 8 weeks for wound infection and another had revision surgery for early loosening; in the midline group, one patient underwent débridement at 8 weeks for an early deep infection. As these patients required a repeat skin incision, they were excluded from the study after the date of reoperation (Fig. 1). One patient in the anterolateral group died before the 6-month visit and two patients in the midline incision group were lost to followup after the 6-week visit (Fig. 1). A total of 30 patients (31 knees) in the anterolateral and 31 patients (32 knees) in the midline incision groups completed all postoperative evaluations. All subjects provided written informed consent and the study received ethical approval from the review boards of all involved institutions.

We expected a decrease in the area of hypesthesia in the anterior aspect of the knee after an anterolateral skin incision compared with a midline incision for TKA. The expected mean surface area of hypesthesia for a midline incision was 66 cm² with an estimated SD of 30 cm² (range, 6–191 cm²) [8]. The expected area of hypesthesia after an anterolateral skin incision has not been documented. The sample size calculation was based on an expected surface area of hypesthesia of 66 ± 30 cm² for the midline incision and 44 ± 30 cm² for the anterolateral

Fig. 2A–B (A) A diagram illustrates the cutaneous nerve distribution in relation to the anterolateral skin incision. (B) A diagram shows a comparison of the anterolateral and midline skin incisions.

incision. By setting the Type I error (α) to 5% ($p = 0.05$) and Type II error (β) to 0.2 (power equal to 80%), the sample size required for each group was 29 patients. A total of 64 TKAs were required to compensate for an expected 10% loss to followup.

The demographic and intraoperative data were similar in both groups (Table 1).

The type of anesthesia (general or spinal) was left to the discretion of the anesthesiologist. In all cases, patients were positioned in the supine position with a tourniquet applied at the proximal thigh. Four surgeons (MF, ML, MM, PAV) performed the surgeries. For the midline incision group, the incision was centered over the patella. After incising the subcutaneous fatty tissue and opening the superficial fascia, a subfascial detachment was made to reach the medial border of the patella. A medial parapatellar arthrotomy was performed 1 cm away from the patella. At its proximal part, the quadriceps tendon was incised in line with its fibers near the myotendinous junction. Distally, the incision was extended to the medial border of the patellar ligament. In the anterolateral incision group [3, 35], the skin incision began in the middle, 5 to 10 cm proximal to the superior border of the patella (Supplemental videos are available with the online version of CORR.). It then was curved toward the anterolateral aspect of the knee, at a distance of 1 cm lateral to the patella, and ended lateral to the tibial tuberosity (Fig. 2B). The superficial fascia was

opened in line with the skin incision. The subfascial plane was developed at the proximal part of the incision next to the musculotendinous plane of the vastus lateralis and rectus femoris. The fascia was elevated in a proximal to distal direction to the level of the patellar tendon and then from lateral to medial up to the junction of the vastus medialis and rectus femoris. The vastus medialis muscle, medial border of the patellar ligament, and medial aspect of the tibia were exposed by reflecting the skin flap without tension (Fig. 3). Afterward, a standard medial parapatellar arthrotomy was performed. The length of the incision was left to the discretion of the surgeon for both groups. Cemented implants (NexGen®; Zimmer Inc, Warsaw, IN, USA) were inserted following the techniques proposed by the manufacturer. Skin closure was performed with metallic staples, and use of an intraarticular drain was left to the surgeon's discretion. Postoperatively, radiographs were taken for all patients to evaluate position of the implants.

On the first postoperative day, patients followed a standard physiotherapy protocol with full weightbearing and continuous passive motion. Discharge was allowed when the patient was ambulating independently and capable of flexing the knee greater than 90°. Postoperative complications (wound-healing problems, such as dehiscence, drainage, or necrosis, and venous thrombosis) were noted.

Table 1. Preoperative and perioperative data

Values	Anterolateral group (n = 34)	Midline group (n = 35)	p Value
Side (R/L)	19/15	20/15	0.93
Age (years)	66.5 ± 9.7	66.4 ± 6.7	0.94
Gender (M/F)	8/26	12/23	0.47
Weight (kg)	83.8 ± 14.1	89 ± 15.9	0.17
Height (cm)	162.4 ± 7.9	165.4 ± 8.4	0.15
BMI (kg/m ²)	32.1 ± 4.5	32.1 ± 5.2	0.99
Total body surface (m ²)	1.92 ± 0.2	2.0 ± 0.2	0.09
Preoperative HKA angle (°)	174.7 ± 6.7	173.3 ± 10.0	0.59
Preoperative WOMAC score	37.7 ± 12.0	43.3 ± 17.8	0.20
Preoperative KOOS score	33.1 ± 8.8	37.5 ± 12.1	0.45
Preoperative SF36 (physical) score	28.1 ± 5.9	29.2 ± 8.4	0.61
Preoperative SF36 (mental) score	45.7 ± 10.9	56.7 ± 11.6	0.002
Passive ROM (°)			
Extension	−4 ± 6.9	−2.8 ± 5.1	0.57
Flexion	109.3 ± 20.0	109.0 ± 16.5	0.97
Anesthesia (spinal/general)	25/9	28/7	0.73
Procedure duration (minutes)	77.1 ± 21.9	70.4 ± 25.1	0.31
Total blood loss (milliliters)	206.3 ± 109.7	172.2 ± 108.8	0.36
Postoperative articular drain (yes/no)	22/12	19/16	0.53
Perioperative complications (yes/no)	9	5	0.21

Values are expressed as mean ± SD; M = male; F = female; BMI = body mass index; HKA = hip-knee-ankle; WOMAC = Western Ontario and McMaster Universities Osteoarthritis index; KOOS = Knee Injury and Osteoarthritis Outcome Score; SF-36 = Short-Form 36; ROM = range of motion.

Fig. 3 Subfascial detachment after an anterolateral skin incision is shown. (Reprinted with permission from Reignier B. La voie d'abord cutanée antéro-externe dans l'arthroplastie totale de genou. *Maîtrise Orthopédique*. 2000;92. Available at: <http://www.maitrise-orthop.com/viewPage.do?id=507>.)

All patients underwent a clinical evaluation preoperatively and postoperatively at 6 weeks, 6 months, and 12 months, by one of two research assistants (DL, GD). Clinical evaluation was performed using the WOMAC [4], KOOS [38], and SF-36 [9]. Passive knee ROM was measured using a goniometer. Scar length was measured.

Cutaneous hypesthesia was assessed with a Semmes-Weinstein monofilament (Touch-TestTM Sensory Evaluators; North Coast Medical Inc, Morgan Hill, CA, USA) at 13 reference points (Fig. 4). A preliminary analysis of five healthy volunteers (10 knees) free of prosthetic surgery and previous incisions allowed us to choose Monofilament Number 5.07 (10 g), which was the monofilament with the smallest size perceived at the 13 points on the anterior aspect of the knee in flexion and extension. Among the patients who had surgery, the monofilament was applied twice for 1 second at each point. Unperceived points were identified and the area of hypesthesia was mapped (Fig. 5). Digital photography of the knee was performed and the absolute surface was measured by the Mesurim Pro 9[®] software (Académie d'Amiens, Amiens, France) after calibration of length. The total body surface of patients was calculated as the average values obtained using the methods described by George and Gehan [14] and Mosteller [34], using height and weight for each patient. The relative area of hypesthesia was expressed in relation to the total body surface. The anterior knee was divided into four quadrants (superolateral, anterolateral, superomedial, inferomedial) using the center of the patella as a reference to locate the zone(s) of hypesthesia [31]. An analysis of intraobserver (JML) and interobserver (JML, AP) reproducibility of the

Fig. 4 A diagram shows the 13 reference points used for Semmes-Weinstein monofilament application.

Fig. 5A–B (A) A diagram illustrates delimitation of the hypesthesia zone. (B) Measurement of the hypesthesia area using the Mesurim Pro 9® software is shown.

calculated area of hypesthesia by computer software was achieved by calculating the intraclass correlation coefficient (ICC). This intraobserver reproducibility (ICC) was 0.993 (95% confidence interval [CI], 0.987–0.996) and the interobserver reproducibility (ICC) was 0.986 (95% CI, 0.974–0.993). Moreover, an analysis of interobserver (JML, DL) reproducibility of the 13-points area mapping on 30 subjects with TKAs showed an ICC of 0.931 (95% CI, 0.839–0.967).

Data were expressed as mean $\pm$ SD. The normality of distributions of variables was verified. To compare means at different evaluations (preoperative, 6 weeks, 6 months, and

12 months) and between the two groups, a paired or unpaired Student's *t* test was used, and a repeated measure ANOVA was performed to compare the area of hypesthesia at different followups. The nonparametric Mann-Whitney *U* test was used in cases of nonnormally distributed data (KOOS, ROM, and hypesthesia area at all followups; WOMAC score at 6 weeks and 1 year; SF-36 score preoperatively and at 1 year; perioperative blood loss). Percentages were compared using chi square test or Fisher's exact test. We looked for potential correlations between sensory disturbances, functional outcomes, and ROM by

Table 2. Subjective and objective hypesthesia

Hypesthesia	Anterolateral group (n = 34)	Midline group (n = 35)	p Value
Surface measured objectively			
6 weeks (cm ²)*	32.3 ± 25.3	75.8 ± 56.6	0.002
6 months (cm ²)*	14.0 ± 13.2	28.8 ± 26.4	0.033
1 year (cm ²)*	6.8 ± 12.2	18.7 ± 27.4	0.045
Percentage of patients reporting presence of hypesthesia around their knee.			
6 weeks (%)	33	79	0.005
6 months (%)	30	76	0.005
1 year (%)	22	47	0.07

* Values are expressed as mean ± SD.

determining the Spearman coefficient. All statistical analyses were performed using StatView[®] software for Windows[®] Version 5.0 (SAS Institute Inc, Cary, NC, USA).

Results

The mean area of hypesthesia was smaller in the anterolateral group than in the midline incision group over the whole study period ($p = 0.004$) and different for each evaluation taken independently: 32 cm² versus 76 cm² at 6 weeks ($p = 0.002$), 14 cm² versus 29 cm² at 6 months ($p = 0.033$), and 7 cm² versus 19 cm² at 1 year ($p = 0.045$) (Table 2). Hypesthesia was reported by 89% of patients in the midline group and 79% in anterolateral incision group. This hypesthesia involved the inferolateral and superolateral quadrants of the anterior aspect of the knee in both groups in similar proportions. We observed a decrease in the surface of hypesthesia between 6 weeks and 6 months in the anterolateral and midline groups ($p = 0.04$ and $p = 0.03$, respectively). Between 6 months and 1 year, hypesthesia decreased in the midline group ($p = 0.04$) but not in the anterolateral group ($p = 0.11$). Presence of anterior knee skin numbness was reported by fewer patients in the anterolateral group at 6 weeks ($p = 0.005$) and 6 months ($p = 0.005$), but at 1 year only a trend was present ($p = 0.07$) (Table 2).

We found no differences regarding ROM, length of the incision, and function at 6 weeks, 6 months, or 12 months (Table 3). At 6 months, greater passive flexion correlated with ($r^2 = -0.242$; 95% CI, -0.492 to -0.042 ; $p = 0.001$) a smaller hypesthesia. At 1 year, we found a correlation between a smaller hypesthesia area and better WOMAC score ($r^2 = -0.104$; 95% CI, -0.309 to -0.001 ; $p = 0.03$) and KOOS ($r^2 = -0.166$; 95% CI, -0.426 to -0.007 ; $p = 0.02$) and greater knee flexion ($r^2 = -0.130$; 95% CI, -0.334 to -0.008 ; $p = 0.01$). Overall, we noted 14 complications in 10 patients (Table 4). Perioperative blood loss (206.3 ± 109.7 mL in the anterolateral group

versus 172.2 ± 108.8 mL in the midline group; $p = 0.36$) and operative time (77.1 ± 21.9 minutes for the anterolateral group versus 70.4 ± 25.1 minutes for the midline group; $p = 0.31$) were similar for both groups. Two hematomas, requiring no specific treatment, were noted in the anterolateral group (6%) versus none in the midline group. No cases of neuroma formation were identified.

Discussion

The anterior midline skin incision provides an excellent surgical exposure while minimizing the length of the incision. However, it also is associated, in 55% to 100% of cases, with persistence of an area of hypesthesia in the anterior aspect of the knee [8, 16, 20, 41]. This complication is secondary to trauma induced to the sensory nerves of the anterior knee during the surgical approach. These nerve branches include the medial femoral cutaneous nerve proximally and the infrapatellar branch of the saphenous nerve distally, which is the most commonly affected branch [1, 17, 18]. Presumably then, an anterolateral skin incision would reduce the amount of trauma to the nerves. We therefore asked whether the anterolateral skin incision in TKA would (1) reduce the area of skin hypesthesia in comparison to a midline incision and (2) influence early knee ROM, WOMAC, and KOOS clinical scores, and local complication rate in comparison to a midline skin incision.

There are some limitations to this study. First, we chose to use Semmes-Weinstein monofilaments to measure the area of hypesthesia. We preferred this method to the use of cotton pieces or a pin [8, 16, 20, 41] because this monofilament test has proven its sensitivity and reliability in research of epicritic sensitivity disorders in diabetic patients for diagnosis of neuropathy [28]. Similarly, this test has been used successfully for evaluation of nerve recovery after surgery on peripheral nerves. The limitation of this method is the lack of distinction between the fine superficial epicritic sensitivity and the painful protopathic

Table 3. Functional scores, clinical scores, and incision length

Variable	Anterolateral group (n = 34)	Anteromedial group (n = 35)	p Value
Preoperative			
WOMAC (points)	37.7 ± 12.0	43.2 ± 17.8	0.20
KOOS (points)	33.1 ± 8.8	37.5 ± 12.1	0.45
SF-36 physical (points)	28.1 ± 5.9	29.2 ± 8.4	0.92
SF-36 mental (points)	45.7 ± 10.9	56.7 ± 11.6	0.002
Passive ROM (°)			
Extension	−4 ± 6.9	−2.8 ± 5.1	0.94
Flexion	109.3 ± 20.0	109.0 ± 16.5	0.85
6 weeks			
WOMAC (points)	74.5 ± 16.6	66.9 ± 19.3	0.16
KOOS (points)	72.2 ± 11.3	62.4 ± 19.4	0.14
SF-36 physical (points)	35.3 ± 9.7	36.1 ± 10.6	0.80
SF-36 mental (points)	49.9 ± 9.9	51.0 ± 10.9	0.68
Passive ROM (°)			
Extension	−1.4 ± 4.3	−1.2 ± 6.9	0.90
Flexion	108.4 ± 16	105.6 ± 15.3	0.49
Incision length (cm)	17.9 ± 3.4	18.2 ± 4.7	0.76
6 months			
WOMAC (points)	82.4 ± 13.2	79.4 ± 19.3	0.93
KOOS (points)	77.7 ± 11.2	76.0 ± 18.2	0.82
SF-36 physical (points)	43.2 ± 9.5	44.3 ± 9.6	0.71
SF-36 mental (points)	50.4 ± 12.2	54.7 ± 8.9	0.17
Passive ROM (°)			
Extension	−0.9 ± 3.3	−0.9 ± 3.4	0.80
Flexion	117.0 ± 10.2	112 ± 12.7	0.19
Incision length (cm)	16.6 ± 3.0	17.1 ± 3.8	0.66
1 year			
WOMAC (points)	84.7 ± 11.1	83.3 ± 15.0	0.7
KOOS (points)	80.5 ± 9.3	78.1 ± 14.2	0.54
SF-36 physical (points)	43.4 ± 9.7	47.0 ± 7.6	0.14
SF-36 mental (points)	53.0 ± 8.9	57.1 ± 7.0	0.09
Passive ROM (°)			
Extension	0.4 ± 1.9	0.2 ± 0.9	0.66
Flexion	114.1 ± 11.8	111.1 ± 23.1	0.55
Incision length (cm)	18.3 ± 4.9	15.5 ± 2.5	0.07

Values are expressed as mean ± SD; WOMAC = Western Ontario and McMaster Universities Osteoarthritis index; KOOS = Knee Injury and Osteoarthritis Outcome Score; SF-36 = Short-Form 36, ROM = range of motion.

sensitivity. Moreover, even if we looked for the presence of hypesthesia or dysesthesia and any scar-related pain, we did not distinguish among the various sensory disturbances, such as anesthesia, hypesthesia, dysesthesia, and hyperesthesia [31]. In fact, it seems, in case of sensory disturbances, it is the latter that is associated with the most disabling discomfort and is at the origin of patient dissatisfaction after TKA [31]. Second, we had no preoperative

Table 4. Postoperative complications

Complications	Anterolateral group (n = 34)	Midline group (n = 35)
Deep venous thrombosis	3	1
Superficial venous thrombosis	0	2
Hematoma	2	0
Wound dehiscence	1	1
Superficial infection	1	0
Deep infection	0	1
Aseptic loosening	1	0
Ankylosis	1	0

Semmes-Weinstein tests to obtain a baseline comparison of sensitivity. However, selecting a randomized study design minimizes selection bias and the patients' similar demographic data support our groups are comparable. Third, a longer duration of followup might have shown further decreases of hypesthesia in the midline and anterolateral incision groups.

We found the area of hypesthesia was smaller up to 1 year after surgery when an anterolateral skin incision was used in comparison to the midline incision. For some authors [41], however, saphenous nerve injury does not appear to be a major concern after TKA. A midline or an anteromedial skin approach implies an almost inevitable section of the infrapatellar branch of the saphenous nerve [16, 27, 32, 33, 42]. Numerous prospective [31] or retrospective studies [8, 16, 20, 41] report hypesthesias after an anteromedial or midline skin incision (Table 5). Müller [35] proposed performing an anterolateral skin incision to avoid damaging the origin of the infrapatellar branch of the saphenous nerve and, thus, reduce secondary hypesthesia. In a retrospective study, Berg and Mjöberg [5] confirmed the usefulness of this incision and reported a reduction in hypesthesia after a lateral skin incision compared with a medial incision in knee surgery for ligamentous injuries (followup of 3 to 6 years). As reported by others [16, 20, 24, 31], we also found a decrease in the area of hypesthesia with time after midline and medial skin incisions. This suggests recovery of nerves traumatized during surgery. However, this recovery is limited and sensory disturbances may be permanent [26, 41, 42]. Moreover, nerve injury may be complicated by the occurrence of neuromas [26, 32, 36, 42], which may require additional interventions [10, 36]. The risk is even greater when the nerve is injured closer to its origin [26]. During an anterolateral skin incision, the smaller terminal branches are sectioned, diminishing the risk of this complication.

We found no difference in knee ROM or clinical scores between the two groups. We did observe a correlation between smaller hypesthesia area and greater knee flexion, along with better WOMAC and KOOS scores at 1 year.

Table 5. Studies reporting hypesthesia after an anteromedial, anterolateral, or midline skin incision

Study	Type of study (level of evidence)	Incision type (number of cases)	Age (years)	Followup	Results
Hopton et al. [16]	Retrospective case series (IV)	Midline incision and medial parapatellar approach (113)	67.3 (range, 38–86)	56.7 weeks (range, 5–227 weeks)	Subjective problems = 60% Objective problems = 86% Surface of hypesthesia = 69.3 cm ² (range, 0.9–198.5 cm ²) Subjective problems = 50/91 (55%) Surface of hypesthesia = 28.9 cm ² (range, 20.9–36.9 cm ²) Subjective problems = 42/76 (55%) Surface of hypesthesia = 23.8 cm ² (range, 15.5–32.6 cm ²)
Sundaram et al. [41]	Retrospective comparative study (III)	Group 1 = medial (91)	71.3 (95% CI = 68.9–73.5)	2.8 years (95% CI, 2.3–3.3) maximum = 7 years	Subjective problems = 37% Objective problems = 100% Surface of hypesthesia = 66 cm ² (range, 6–191 cm ²) Sensitive problems* = 25/35 (71%) Surface of hypesthesia = 53 cm ² (range, 6–219 cm ²)
Borley et al. [8]	Retrospective case series (IV)	Midline incision (25)	79 (range, 41–88)	11 months (range, 4–48 months)	Objective problems = 70 % Localization of problem = SL = 8/20; IL = 14/20 (hyperalagia = 5, paresthesia = 2, decreased sensation = 2, complete numbness = 5); IM = 3/20; SM = 2/20
Johnson et al. [20]	Retrospective case series (IV)	Median parapatellar incision (36)	67 (range, 29–87)	3 months to greater than 2 years [†]	Subjective problems = 22% Surface of hypesthesia = 6.8 ± 12.2 cm ²
Mistry et al. [31]	Prospective case series (IV)	Localization of incision? (31 - 10 lost to followup and 1 excluded)	72.7 (range, 59–86)	14 months (range, 6–20 months)	Subjective problems = 47% Surface of hypesthesia = 18.7 ± 27.4 cm ²
Current study	Prospective, randomized (I)	Group 1 = anterolateral skin incision (34) Group 2 = midline skin incision (35)	66.5 ± 9.7 66.4 ± 6.7	1 year 1 year	

[†] Mean followup not mentioned; *type of problem (subjective or objective) not mentioned; SL = superolateral; SM = superomedial; IL = inferolateral; IM = inferomedial.

This weak trend may suggest the interest in limiting the area of hypesthesia on the anterior knee in the postoperative period. This is supported by 4% to 10% reported rates of sensory disturbances important enough to interfere with activities of daily living [8, 16, 31] after a midline or medial skin incision for TKA. One randomized prospective study of 49 cases showed the midline incision resulted in more instances of wound dehiscence, longer healing time, and more lateral flap numbness at 6 weeks postoperatively than the anterolateral skin incision [40] (Table 5). The anterolateral incision is curvilinear and parallel to the lines of Langer, generating less tension during mobilization of the knee. This may facilitate wound healing [29], and thus, could reduce the risk of wound problems. Johnson et al. [23] reported that after a TKA using a medial skin incision, vascularization of the lateral skin flap was more precarious than that of the medial skin flap [21]. The cutaneous vascularization to the anterior knee comes mostly from a medial vascular network, with a smaller contribution from a laterally located network. An anterolateral incision avoids the occurrence of a central hypovascular band, which may lead to wound complications [11]. Moreover, this incision allows the skin incision to be farther away from the arthrotomy, which potentially limits the risk of articular contamination in case of wound-healing problems [22].

We believe the anterolateral skin incision is a reasonable alternative surgical approach to TKA. Compared with the midline incision, it is associated with less sensory disturbances in the anterior aspect of the knee. Our findings are applicable for the choice of skin incision for other knee procedures, such as fracture fixation, osteotomy, and arthroscopy [25].

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