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Original Article

Pin Site Complications Associated With Computer-Assisted Navigation in Hip and Knee Arthroplasty

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ABSTRACT

Background: There has been a great increase in the use of navigation technology in joint arthroplasty. In most types of navigation-assisted surgery, several temporary navigation pins are placed in the patient. Goals of this study are (1) to identify complications and (2) risk factors associated with placement of these pins.

Methods: This is a retrospective cohort study of all navigation-assisted hip and knee arthroplasty performed a single institution over a 3-year period. Records were reviewed and outcome measures were tabulated in a database. Complications included in the database were pin site infection, deep prosthetic joint infection, neurologic injury, vascular injury, and fracture through a pin site.

Results: A total of 3136 pin sites in 839 patients were included in the study. Five pin site complications were reported with a complication rate of 0.16% per pin site and 0.60% per patient. The complications-per-procedure were slightly higher for unicondylar knee arthroplasty (0.64%) compared with patellofemoral arthroplasty (0%) and total hip arthroplasty (0.46%), but not statistically significant. There were three infections, one neuropraxia, and one suture abscess. No periprosthetic fractures through a pin site were reported. All complications were resolved with nonoperative treatment. The infections required oral antibiotics, and were associated with transcortical drilling in two cases and juxtacortical drilling in the third.

Conclusion: Pins required for navigation-assisted arthroplasty have a low complication rate. Transcortical or juxtacortical drilling may be a risk factor for pin site infection; future studies should be directed at quantifying this effect.

The number of arthroplasty procedures performed in the United States is expected to increase to nearly four million by the year 2030 [1,2]. Hip and knee arthroplasties have a dramatic positive effect on patients' lives, adding quality adjusted life years in a cost-effective manner, with satisfaction rates approaching 95% and 80%, respectively [3–6]. Durability is a concern, and recent Medicare and registry data show a 10% rate of revision within 10 years after surgery [7–10]. Some surgeons achieve durability as high as 93% at 20 years [11], but others have observed greater rates of failure [12,13]. Variations in implant choice and patient characteristics undoubtedly account for some portion of the observed variability in prosthetic durability, but surgical technique has proven to be contributory [8,9].

With the massive increase in arthroplasty predicted, efforts to improve technique have led to new technologies. Navigation and robotic technology purports to improve outcomes by assisting in preoperative planning and surgical execution; greater precision in bone preparation and implant placement may potentially lead to improved clinical outcomes [14–16]. It has been shown that surgeries performed using navigation delivers immediate improvements in surgical quality and accuracy without exposing the patient or the surgeon to a clinically important learning curve [17,18].

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In most types of navigation-assisted surgery, several temporary pins must be placed in the patient, either within the operative field or percutaneously through separate stab incisions. These pins are secured in the ilium for procedures around the hip, and in the femoral and tibial diaphysis for procedures around the knee. These pins represent additional surgery to the patient that is likely benign but may have associated complications. Concerns include fracture, hematoma, nerve injury, and pin site infection. The goals of this study are (1) to clarify what complications occur with the placement of these pins and (2) identify any associated risk factors for these complications.

Materials and Methods

This is a retrospective study analyzing patients undergoing elective hip and knee surgeries at a single institution using navigation-assisted arthroplasty between January 2013 and December 2015. Institutional review board's approval was obtained before initiation of the study.

Subjects

This study is a retrospective cohort on navigation-assisted arthroplasty performed by 1 of 4 surgeons at a single institution over the 3-year study period. All patients having a navigation-assisted unicondylar knee arthroplasty (UKA), navigation-assisted patella-femoral arthroplasty (PFA), and navigation-assisted total hip arthroplasty (THA) were included. All cases were performed using the MAKO RIO (Robotic-Arm Interactive Orthopaedic System, Stryker Mako, Fort Lauderdale, FL). Minimum follow-up for all patients is 1 year.

Surgical Technique

For all three types of navigation-assisted arthroplasty, preoperative computed tomography scans of the involved joint were obtained and preoperative planning was performed using computer software. Self-drilling, self-tapping navigation pins, 4 mm in diameter, were placed through percutaneous stab incisions using a standard sterile power drill to allow for intraoperative registration of bony landmarks.

For anterior-approach THA, three pins were placed in the contralateral iliac crest. Separate stab incisions were made superolateral to the anterior superior iliac spine, centered over the inner and outer table of the ilium. Blunt dissection to the periosteum was performed with a curved clamp. The pins were placed to a depth of 2-3 cm. For posterior-approach THA, three pins were placed in the outer table of the ipsilateral hip. Separate stab incisions were made in the gluteal area approximately 4 cm cranial to the proximal end of the surgical incision. Pins were directly placed in the outer table 2-3 cm in depth without blunt dissection (Fig. 1).

For medial or lateral UKA, two navigation pins were placed in the tibial diaphysis and two in the femoral diaphysis. For the tibia, two stab incisions were made over the medial tibial diaphysis. Blunt dissection to the periosteum was performed with a curved clamp. Two pins were placed bicortically with saline irrigation; tactile and auditory feedback was used to assess proper pin depth while drilling the second cortex. For the femur, two stab incisions were made over the anterolateral thigh approximately 6 cm proximal to the superior pole of the patella. Similar to the tibia, two pins were placed bicortically (Fig. 2). For PFA, no tibial pins were necessary; femoral pins were placed in the same manner as that described for UKA.

After completion of the procedure, all pins were removed. Wounds were irrigated with pulsatile lavage and closed with either 3-0 monocryl in continuous subcuticular stitch or 3-0 nylon in a simple interrupted stitch. They were dressed with a dry dressing using sterile gauze for a minimum of 2 days. Postoperatively, all patients were allowed to weight bear as tolerated.

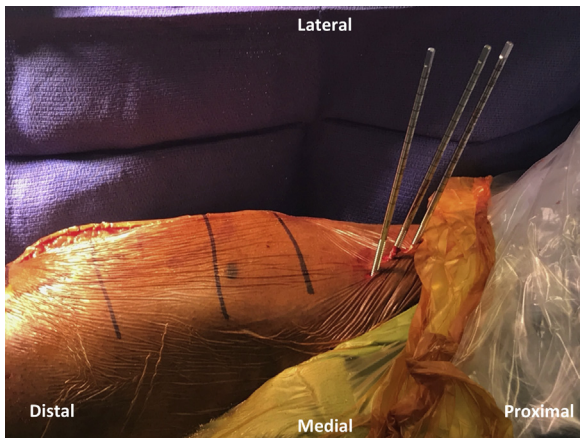

Fig. 1. Setup for navigation-assisted posterior approach total hip arthroplasty (THA). The array pins are caudad to the incision, secured in the outer table of the ilium.

Statistical Analysis

Patient records were reviewed for operative details and clinical outcomes. Outcome measures were tabulated in a database. Complications included in the database were pin site infection, deep prosthetic joint infection, neurologic injury, vascular injury, and fracture through a pin site. Statistical analysis was performed using Microsoft excel. Means and percentages were calculated. Chi-square test was used to determine statistical significance.

Results

A total of 3136 pin sites in 839 patients were included in the study (Table 1). Five pin site complications were reported with a complication rate of 0.16% per pin site and 0.60% per patient. No periprosthetic fractures through a pin site were reported. One temporary contralateral neuropraxia of the lateral femoral cutaneous nerve developed when pins were placed into the contralateral iliac crest during an anterior-approach THA. This neuropraxia resolved with no additional treatment after 3 months. One patient developed a

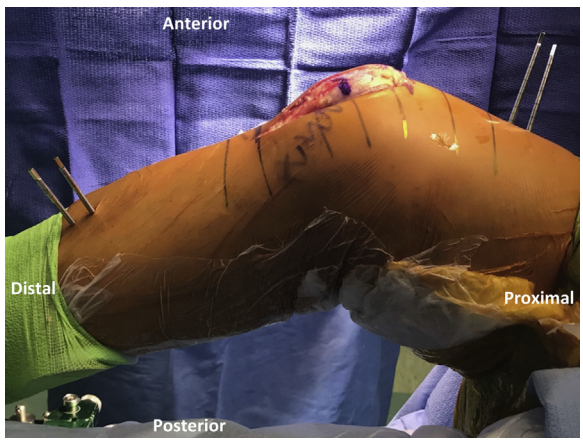

Fig. 2. Setup for navigation-assisted unicondylar knee arthroplasty (UKA). The array pins are in the femoral and tibial diaphysis.