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Case Report

A numerical misinterpretation in the computer screen during middle of the image free navigation assisted knee replacement-a dilemma of what to do next?

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ABSTRACT

Misinterpretation can occur during any step of navigation system. It is not only a dilemma for the orthopaedic surgeons on how to proceed further in such instances, but also a challenging situation to take a right call. We report here an unusual error encountered in image free Orthopilot navigation system during knee replacement surgery. A gross numerical measurement error occurred in the computer screen while femoral planning step in the tibia first technique, following which a dilemma persisted on how to proceed further. The system was reverted backwards, and the procedure was initiated again right from the beginning of the registration of bony landmarks, followed by completion of all other consecutive steps with the help of navigation system. The end result of the surgery was achieved at an accurate neutral mechanical axis with 5 degrees of maximum possible extension.

Keywords: Bony landmark registration, Misterpretation in computer screen, Navigation assisted knee replacement

INTRODUCTION

Navigation was introduced in knee replacement to improve the accuracy of implant positioning.

Despite the ongoing controversies on long term functional benefit of navigation over conventional knee replacement, many studies have proved that navigation is associated with over all better alignment of component in all the planes and also there is considerable reduction in number of outliers.[1,2]

An unusual error in displaying the numerical measurements that was encountered in the middle of the surgery, following which how the error was rectified is presented in this study. It had also been tried to trace out the possible cause of error that could be attributed to the numerical mismatch which was encountered during the surgery to avoid future recurrence.

CASE REPORT

The present surgical procedure was carried out on a 52-year-old male patient with severe osteoarthritis knee after standard preoperative planning. Image free Orthopilot system and TKA software for navigation was used. Positioning and sterile draping was done. A suitable leg holder was used to facilitate leg control. Orthopilot machine was positioned on the side opposite to the leg, which was to be operated. The camera was positioned at the shoulder height of the patient aligning 45 degrees to the surgical field. Basic demographic details of the patient and related information were entered on to the computer data base. The standard medial parapatellar approach was used. Femoral and tibial transmitter were placed. Registration of bony landmarks were carried out. Hip, knee and ankle joint centre were determined. Controlled tibial plateau resection was done and reassessed. Then femoral condylar recording (four-point

contact) and femoral sizing were determined. Flexion and extension gap measurement were done. In the femoral planning step there was a gross mismatch between the amount of estimated bone resection, measured, remaining flexion extension gap and the size of the components displayed on the computer screen. We were puzzled, not knowing what went wrong and were clueless on how to proceed further. Few of us thought it could have been a software associated problem and wanted to abandon the navigation. But rather than abandoning the navigation system we took a prudent decision of reverting the system backwards and reinitiating the procedure right from the bony land mark registration. Tibial resection and flexion and extension gap measurements were repeated. Femoral planning and resection were completed without any discrepancy. Trial implants were placed. A sign of relief was achieved after seeing the accurate neutral mechanical axis and 5 degrees of maximum possible extension on the screen. Then definitive implant (Cruciate retaining e-motion prosthesis) was placed. We cemented only the tibial and patellar prosthesis. Closure was done in standard manner.

DISCUSSION

The advantage of computer assisted navigation is the reduction of outliers in mechanical axis and component positioning. In addition, navigation allows for a more accurate and reproducible evaluation of component sizing, kinematics, and ligament balancing.[3]

In the present case scenario, a numeric misinterpretation was suddenly encountered in the computer screen during the middle of the navigation surgery. Under such crucial circumstances the surgical team is subjected to heavy frustration, pressure and tend become clueless on not knowing which direction to proceed further. Even though the surgery is carried out under the high precision guidance of navigation, error may occur in manual, non-navigated steps of the procedure during registration of bony landmarks, bone resection and implantation.[4] Hasegawa et al., has evaluated the cutting error and implantation error in minimally invasive navigation arthroplasty.[5]

In this case the cutting error had been overcome by reassessment of bone resection and the implantation error was ruled out because we had encountered the numerical misinterpretation prior to the implantation step. In the present case the error could have possibly occurred because of manual or software related inaccuracy during registration. Few authors have defined and evaluated the registration process error in cadaveric studies.[6-8] So, it is mandatory that the operating surgeon should be well aware of the importance of anatomical bony landmarks with high precession and accuracy. The accurate anatomical landmarks on the femur are, middle of the trochlea at the edge of the intercondylar notch, posterior most point on the postero-medial, lateral condyle and anterior most point on the anterior femoral cortex. On the tibia the centre of the anterior edge of the anterior cruciate ligament, deepest point of defect on medial and lateral tibial plateau surface should be registered. In the present case we had not registered medial and lateral epicondyle, because these landmarks have less than 2mm of safe zone.[9]

CONCLUSION

Misinterpretation can occur during any steps of computer assisted navigation system as they are an electronic aid in assisting the surgical procedure. Only the surgeons who clearly understand and has a sound knowledge on the technology and surgical procedure, can evaluate the potential errors and estimate the limitations of navigation system can take a prudent decision on how to proceed further under such critical and crucial circumstances. In the present case situation, the error was attributed to improper bony landmark registration. To circumvent such mistakes in future, it is always advisable to carry out each and every step carefully and properly. When such a circumstance occurs its prudent to redo the surgical procedure from the beginning with accurate registration of bony landmarks.

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