

“TKA Box View” for Periprosthetic Distal Femur Fractures Using 3-Dimensional Image Processing

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Purpose: Plain radiographs and CT are poor diagnostic tools for evaluating if a TKA femoral prosthesis will allow passage of a retrograde intramedullary nail. The purpose of the study was to develop and validate the “TKA box view” for detecting if a total knee arthroplasty (TKA) femoral prosthesis is amenable to intramedullary nail fixation of a periprosthetic distal femur fracture.

Methods: A TKA box view was generated digitally from axial CT scans using standard 3-dimensional image processing. 12 patients with known TKA prostheses (6 open box, 3 closed box, 3 cruciate-retaining designs) were identified with IRB approval. Plain radiographs, axial CT images, and TKA box view images for each patient were shown to 4 residents and 4 trauma fellowship-trained attendings who were asked to identify if the femoral prosthesis would accept a retrograde intramedullary implant. The TKA box view was compared to radiographs and CT images for sensitivity and specificity using Stuart-Maxwell test for marginal homogeneity.

Results: TKA box view has excellent sensitivity and specificity of 81% and 97%, respectively. Positive predictive value was 100%, negative predictive value was 85%. For predicting if the box is open the TKA box view performs better than both plain radiographs and CT. TKA box view has better sensitivity and specificity than CT scan and has better specificity than radiographs. Intraclass correlation test for interobserver reliability was excellent at 0.88.

Conclusion: Periprosthetic distal femur fractures are a diagnostic and therapeutic challenge. Intramedullary implants offer several advantages in treating these fractures when they are compatible with the prosthesis. Unfortunately, preoperative imaging is unreliable for determining if an intramedullary nail will pass through the prosthesis. We present a novel and validated 3-dimensional image processing technique that is useful and reliable for evaluating periprosthetic distal femur fractures and choosing an appropriate implant.

