Comparing Navigation Efficacy of Remote vs. Conventional Catheter Navigation using Multiple Operators in a Multi-Path Phantom

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Radiation exposure and chronic musculoskeletal injury are occupational risks to interventionalists performing fluoroscopic, x-ray guided, catheter procedures. A remote catheter navigation system (RCNS) has been developed to allow these procedures be performed from a location remote to the patient. The RCNS employs tele-operation, utilizing the dexterous skills required during conventional bedside guidance, while navigating the catheter from a remote, safe location. This study compares the navigation efficacy of remote catheter navigation vs. conventional guidance in a custom, multi-path model, for an experienced interventionalist and a novice operator. Each operator trained for one hour on the RCNS, then manually manipulated a 5F catheter through 16 predefined paths in the multi-path model. After one week, the operators repeated the experiment using the RCNS. X-ray fluoroscopy with digital road-mapping provided real-time images of the catheter through the model. Successfully completed paths and total procedure time were recorded for all trials. Both operators successfully traversed all paths (16/16) using both navigation methods. Navigation time using conventional guidance (experienced: 23.5±11.2s, novice: 23.8±9.2s) was less than the navigation time required using the RCNS (experienced: 33.9±20s, novice: 42.1±23.7s). In four paths, the RCNS performed better than conventional guidance, while in one path, 73s more navigation time was required using the RCNS. This high variability is associated with difficulty of the traversed path. In summary, the results indicate that remote catheter navigation has navigation efficacy comparable to conventional guidance, allowing for catheter navigation from a remote location with only a slight increase in required navigation time.