

What is the expected learning curve in computer assisted navigation for bone tumor resection?

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Background: Computer assistance and navigation can help oncologic surgeons to perform more accurate resections. However, some navigation studies suggest that this assistance may originate some handling and operating room setting problems and also increase surgical time. These intraoperative difficulties are probably related with different factors but, the learning curve applies to every surgeon who attempts a new technique.

Questions: To evaluate the performance with this new technology we purposed to answer the following questions: 1) Which were the intraoperative technical problems during the first 2 years using navigation? 2) Which was the mean time for navigation procedures and the time improvement during the learning curve? 3) Have been any differences in the accuracy of the registration technique over time? 4) How were the histological surgical bone margin obtained in the entire specimen resections?

Methods: All patients preoperatively virtually planned for tumor bone resections and treated with navigation assistance from 2010 to 2012 were prospectively collected. Seventy-eight consecutive patients treated with this technology were included in the study. Technical problems (crashes) and time for navigation procedure were reported after

surgery. Accuracy of the registration technique and surgical margins were defined after surgical specimen examination

Results: In four patients (5%) the navigation was not completed due to technical problems, all occurred during the first year of the utilization of this technology. Of the 74 cases where the navigation was performed, the mean time for navigation procedures during surgery was 31 minutes (range 11-61), and the firsts navigations took more time ($p < 0.001$). The median registration error was 0.6 mm (range 0.3-1.1). Registration did not improve over time ($p=0.15$). Histological examinations of all specimens showed a clear bone tumor margin in all patients. Seven cases of the 78 patients had a local recurrence (9%). We observed a local recurrence rate of 22% in pelvic tumors and 5% in the extremities tumors. All local recurrences were related with patients with soft tissue marginal resections.

Conclusion: The navigation could not be performed in 5% of the cases. The surgical navigation time decreased after getting more experience on the procedure but, we did not improve the registration error over time. Oncologic results are acceptable but a longer follow-up is needed to confirm this result.

Level of Evidence: Level IV, therapeutic study.

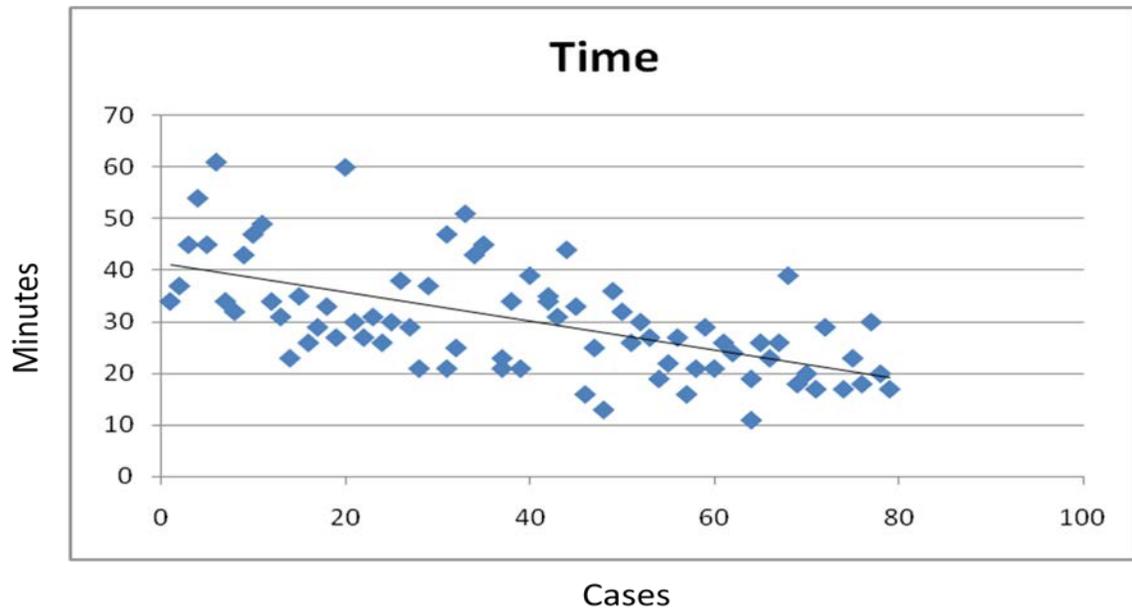


Figure 1: Diffusion graphic that shows how the procedure time decreased over time.

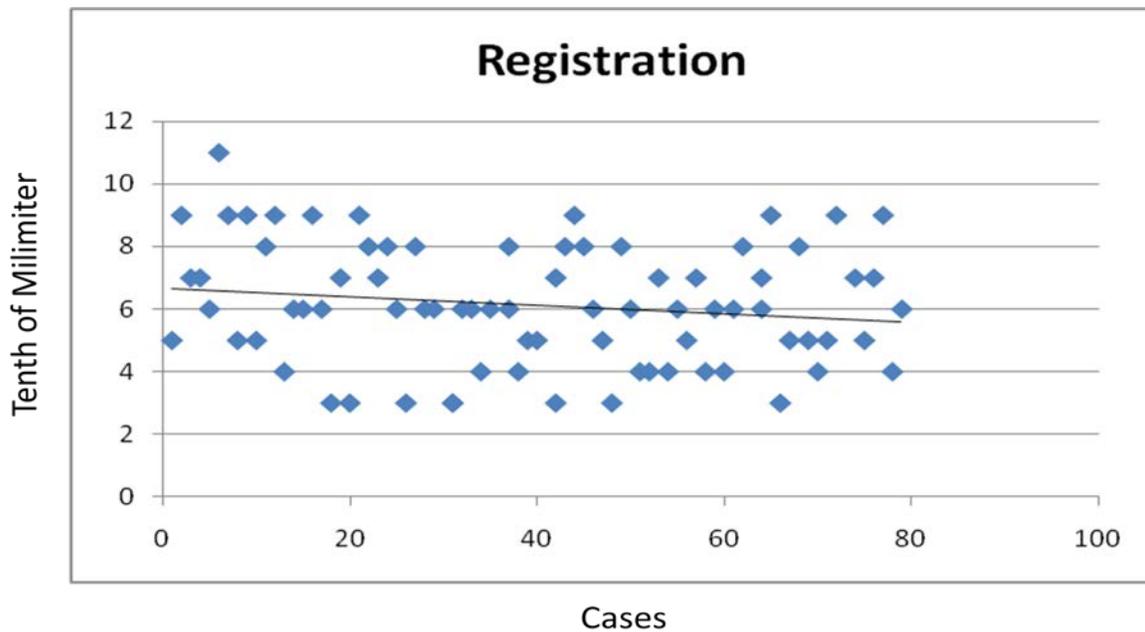


Figure 2: Diffusion graphic that shows how the registration accuracy did not improve over time.