Fluoroscopic exposure during transforaminal epidural steroid injections – a multi-center evaluation of 4,793 injections

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Abstract

Introduction: Radiation exposure carries significant health risks for patients and healthcare providers. We aimed to evaluate the effect of a patient’s body mass index (BMI) on fluoroscopic exposure time (FET) in lumbosacral transforaminal epidural steroid injections. Materials and Methods: IRB approval was obtained at all institutions. We retrospectively collected procedure data from 3,678 patients from 4 outpatient academic institutions, accounting for 4,793 individual injections. We examined FET and its relation to BMI, age, presence of a trainee, and pain score by linear regression. Results: BMI was positively correlated with FET (r(4666) = 0.13, p < 0.001). Mean FET values were 31.5 ± 16.8 s, 28.9 ± 22.4 s, and 26.4 ± 16.3 s for obese, overweight, and normal BMI patients. Age was positively correlated with FET (r(4670) = 0.10, p < 0.001). One institution also recorded fluoroscopic dose (mGy·cm2), which was more strongly correlated with BMI (r(1930) = 0.48, p < 0.001). FET was significantly greater when trainees were not present (31.0 ± 21.7 s) than when trainees were present (27.7 ± 16.9 s), p < 0.001. There was no relationship between BMI and improvement in pain score (p = 0.612). Conclusions: There is increased fluoroscopic exposure for patients with larger BMI. Patients and healthcare providers should be aware of these risks. The presence of trainees do not appear to increase fluoroscopic exposure, though this may be related to selection bias.

Materials & Methods

Methods

• Retrospective review of all lumbar TFEIs at four academic institutions
• Primary outcome measure: FET.
• Secondary outcome measures: immediate improvement in pain score.
• Demographic information collected: Age, gender, BMI, trainee (resident or fellow) involvement
• Multiple injections performed on the same patient (e.g. bilateral or two-level injections) were included in the analysis, with the corresponding FET divided by the total number of injections
• Statistical analysis
  - Linear regression for correlation of outcome variables with BMI and age
  - Analysis of variance for correlation of outcome variables with gender and trainee involvement

Participants

• 4,793 injections, performed on 3,678 individual patients.
• 50.5% of the patients were female
• Mean BMI was 28.4 (see figure 1)
• 30 different attending physicians performed the injections, ranging from 1 to 531 injections per physician
• 44.2% of injections were performed on the right side, 40.5% were on the left, and 15.1% were bilateral.
• 68.5% of injections were single injections (one side, one level).
• There were no serious immediate complications

Results

• There was a significant difference between institutions in terms of FET (p < 0.001) with mean fluoroscopic times per injection ranging from 22.1 to 35.1 seconds.

Figure 2 – Fluoroscopic exposure time (FET) per patient, in seconds, separated by body mass index (BMI). p < 0.001 between groups.

• Age was positively correlated with FET (r(4760) = 0.10, p < 0.0001)
• Men had a significantly longer FET compared to women (30.1s vs. 28.8s, p = 0.050)
• One institution also recorded fluoroscopic dose (mGy·cm2), which was more strongly correlated with BMI (r(1930) = 0.48, p < 0.001).
• FET was significantly greater when trainees were not present (31.0 ± 21.7 s) than when trainees were present (27.7 ± 16.9 s), p < 0.001.
• There was no relationship between BMI and improvement in pain score (p = 0.611).

Figure 3 – Scatter plot of fluoroscopic exposure time for all body mass indices. r(4666) = 0.13, p < 0.001

Discussion

• Patients with larger BMI appear to have more fluoroscopic exposure time
• As radiation dose generally increases with BMI, actual radiation exposure is increased for those with larger BMI
• Age and BMI both had weak Pearson correlations, suggesting that although significant, their correlation with FET contributes a relatively small percentage to the total variance seen within FETs
• Men have slightly larger FET, which may be more of a function of men having larger BMI than women in this study
• Trainees did not increase FET; interestingly, they actually decreased the time. The reasons for this finding remain speculative.
• Future studies are required to assess the excess radiation dose given to patients with elevated BMI. However, it would appear that although significant, the effect of BMI likely has a clinically small effect on radiation exposure.

Limitations

• Retrospective study
• Only academic institutions
• Multiple attending physicians with varying levels of experience
• Varying techniques used, depending on training and institution
• The effects of digital subtraction were not analyzed in the subset of patients on which it was utilized

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