CLINICAL STUDY

Patient Radiation Exposure in Transradial versus Transfemoral Yttrium-90 Radioembolization: A Retrospective Propensity Score–Matched Analysis

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ABSTRACT

Purpose: To compare differences in patient radiation exposure (PRE) during transarterial yttrium-90 (^{90}Y) radioembolization (TARE) between transradial access (TRA) and transfemoral access (TFA).

Materials and Methods: A total of 810 consecutive first-time TARE procedures in patients from 2013 to 2017 were retrospectively reviewed. A propensity score–matching (PSM) analysis matched TRA and TFA groups on the basis of patient age, sex, weight, height, cancer type, ^{90}Y microsphere type, and number of previous procedures from the same and opposite approaches. Matched groups were then compared by PRE measures fluoroscopy time (FT), dose-area product (DAP), and cumulative air kerma (AK). Effect size for each PRE measure was calculated.

Results: Before PSM, TRA and TFA groups differed significantly in mean age, weight, and number of previous procedures from the same and opposite approach (all $P < .05$). After PSM, each group consisted of 302 procedures (overall, n = 604) and no longer differed in any procedure performed before surgery measure. TRA did not differ from the matched TFA group regarding median FT (9.50 vs 9.40 minutes, $P = .095$), median DAP (67,066 vs 67,219 mGy·cm^2; $P = .19$), or median AK (323.63 vs 248.46 mGy; $P = .16$). Effect sizes were 0.068, 0.054, and 0.110 for FT, DAP, and AK, respectively.

Conclusions: No statistical differences were found for PRE measures between the matched TRA and TFA approach groups. Furthermore, practical effect sizes were considered to be small for AK and less than small for FT and DAP, and therefore, any differences in PRE between the radial and femoral approaches for TARE are minor and unlikely to be noticeable in everyday clinical practice.

ABBREVIATIONS

AK = air kerma, DAP = dose-area product, FT = fluoroscopy time, PRE = patient radiation exposure, TARE = transarterial yttrium-90 radioembolization, TFA = transfemoral access, TRA = transradial access, ^{90}Y = yttrium-90

Selective internal radiation therapy, though shown to be a safe and effective treatment for hepatocellular carcinoma (HCC) and other primary and secondary hepatic tumors, can expose patients to a significant amount of procedure-related radiation (1–3). In recent years, there has been increasing use of a transradial access (TRA) as an alternative to

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EDITORS' RESEARCH HIGHLIGHTS

- This retrospective study used propensity-score matching to compare patient radiation exposure from transradial versus transfemoral approaches during transarterial radioembolization. Each group consisted of 302 patients (overall, n = 604) undergoing consecutive transarterial yttrium-90 radioembolization procedures over a 4-year period. All procedures were performed by 5 interventional radiologists with extensive previous experience with both transradial and transfemoral approaches for hepatic radioembolization.
- There were no significant baseline or procedural differences among the compared cohorts. The mean number of digital subtraction angiograms (DSAs) per patient, mean total number of DSA images, mean number of cone-beam computerized tomograms (CTs) per patient, and mean total number of cone-beam CT images did not differ between the 2 groups.
- The authors compared patient radiation dose but did not evaluate operator exposures. Peak skin doses were not monitored in the patients and air kerma data was available for only 32% of the transradial patients and 22% of the transfemoral patients.
- Patient radiation exposure, measured by means of fluoroscopy time, dose-area product, and cumulative air kerma, were not significantly different between the transradial and transfemoral approaches.

transfemoral access (TFA) for noncoronary interventions, including ^{90}Y transarterial radioembolization (TARE), owing to improved patient satisfaction, bleeding complications, and cost savings (2,4–9). The use of TRA has also increased in procedures such as transarterial chemoembolization, prostatic artery embolization, uterine artery embolization, as well as others (5,8,10–16). Given the increased use of TRA, it has become relevant and necessary to assess differences between the access site approaches in procedure-related radiation exposure to patients.

Large randomized trials in interventional cardiology have not found any significant differences in patient radiation exposure (PRE) measures, including fluoroscopy time (FT), dose-area product (DAP), and air kerma (AK), between TRA and TFA cardiac catheterization procedures (17,18). Similarly, the few studies of PRE in noncoronary interventions, including transarterial chemoembolization and prostatic artery embolization procedures, also have found no differences in FT, DAP, or AK between the TRA and TFA approaches, although 1 study of transarterial chemoembolization reported shorter FT for the TRA approach (8). For TARE specifically, however, Kis et al recently reported significantly greater FT and radiation dose (as measured by AK) in TRA procedures compared with TFA in a review of 64 treatments (4).

In current practice, the decision to perform a TARE procedure with the use of a TRA or TFA approach is largely made on an individual basis and relies on a variety of factors, including a patient's age and body type, previous location and use of the access site, and interventionalist experience or preference (9,18,19). Therefore, it is important to control for a number of these factors when making comparisons between the approaches when randomization cannot be achieved. The goal of the present study, which included consecutive TARE procedures over a 4-year period performed with the use of TRA and TFA approaches, was to match patients on baseline factors that may influence the likelihood of using 1 access site over the other to compare PRE measures between the TRA and TFA approaches in a large, but controlled, sample.

MATERIALS AND METHODS

Study Design

This retrospective single-center study was reviewed and approved by the medical center Institutional Review Board. Medical records of consecutive patients who underwent a TARE procedure during a 4-year period from July 1, 2013, to June 30, 2017, were included in the study (n = 1,058 procedures). TARE procedures were performed with the use of either TRA or TFA approach in all patients. Absolute contraindications to the TRA approach include radial artery occlusion, small radial artery diameter (<2 mm), and hemodialysis requirement (11). Procedures without available imaging or adequate radiation exposure information, or in which there was a crossover switch of access site during the procedure, were excluded, reducing the sample to 1,005 procedures in 810 patients. To eliminate any intrapatient correlation, only the first TARE procedure of each patient was included, resulting in a final sample of 810 procedures. Of these, procedures were matched in a propensity score–matching (PSM) manner on the basis of age, sex, weight, height, cancer type, previous same and opposite access site interventions, and ^{90}Y microsphere type to evaluate differences in PRE measures between TRA and TFA groups.

Patients

The study sample included 467 patients from the TRA approach and 343 patients from the TFA approach. The mean age of the patients at the time of the procedure was 65.8 ± 10.5 years, and the cohort was 27.4% female and 72.6% male. The mean weight and height of patients at the time of the procedure were 76.1 ± 16.5 kg and 1.69 ± 0.1 meters, respectively. The most common cancer type was hepatocellular carcinoma (81.2%), followed by a metastasis (15.7%) and other cancers (3.1%). Other cancers included cholangiocarcinoma and gallbladder cancer. Patients were not excluded based on cancer type. At the time of the TARE procedure, whether with TRA or with TFA, there were 7.0% no, 75.9% 1, and 17.0% ≥2 previous same-access approach interventions. There were 81.2% no, 12.7% 1, and 6.0% ≥2 previous opposite-access approach interventions. Overall, 85.8% of TARE procedures used Therasphere (BTG),