Short-term Outcomes of Intraoperative Cell Saver Transfusion During Open Partial Nephrectomy

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OBJECTIVE To determine whether transfusion using the Cell Saver system is associated with inferior outcomes in patients undergoing open partial nephrectomy.

METHODS All patients who underwent open partial nephrectomy by a single surgeon (BJD) from August 2008 to April 2015 were retrospectively identified. Operations were grouped and compared according to whether they included a transfusion using the Cell Saver intraoperative cell salvage system.

RESULTS Sixty-nine open partial nephrectomies in 67 patients were identified. Thirty-three procedures (48%) included a Cell Saver transfusion. Most tumors were clear cell renal cell carcinoma (62%) and stage T1a (68%). There were no significant differences between groups for any measured clinical or pathologic characteristics. Operations including a Cell Saver transfusion were longer (141 vs 108 minutes, P <.001), had significantly greater blood loss (600 vs 200 mL, P <.001), and had longer median renal ischemia times (15 vs 10 minutes, P = .03). There were no significant differences in postoperative complication rate (21% vs 17%, P = .83) or median length of hospital stay (3 vs 3 days, P = .09). At a median follow-up of 23 months (interquartile range: 8-42 months), 1 patient in the non-Cell Saver transfusion group had cancer recurrence. There was no metastatic progression or cancer-specific mortality in either group.

CONCLUSION Cell Saver transfusion during open partial nephrectomy was not associated with inferior outcomes with short-term follow-up, and no patients developed metastatic disease. UROLOGY 86: 1153–1158, 2015. © 2015 Elsevier Inc.

Kidney cancer is one of the most common malignancies in the United States, and will account for an estimated 61,560 new cases and 14,080 deaths in 2015.[1] The kidney is a highly vascular organ, and blood loss during surgery for renal cell carcinoma (RCC) can be significant. Perioperative transfusion rates for partial and radical nephrectomy are known to range from 2.6% to 21%.[2-5] Notably, perioperative blood transfusion is an independent risk factor for decreased cancer-specific and overall survival in patients with RCC.[3,6] An exact mechanism underlying this association is not known, although some work has suggested that allogenic blood transfusion may promote tumor growth either through an immunosuppressive effect or through the provision of growth factors to malignant cells.[7-9]

One proposed method to reduce the need for allogenic blood transfusion is intraoperative blood salvage using the Cell Saver system, which involves collection of blood lost during surgery with subsequent autotransfusion of the patient's own cells. Reports of malignant cells found in blood samples taken from autotransfusion units[10-12] have fueled concern that Cell Saver transfusion may reintroduce viable malignant cells into circulation and increase the risk of metastatic progression. However, subsequent work has showed no increase in the risk of cancer recurrence or death with the use of Cell Saver in cervical, gastrointestinal, prostate, and bladder cancers.[13-17] To our knowledge, the use of Cell Saver during partial nephrectomy has not been examined.

To examine the safety of Cell Saver transfusion in patients with localized RCC, we reviewed our single-surgeon series of open partial nephrectomy and compared outcomes in patients stratified by whether they received a Cell Saver transfusion.

METHODS

Patients and Study Design

We retrospectively identified all patients who underwent open partial nephrectomy by a single surgeon (BJD) at our

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institution between August 2008 and April 2015. Electronic medical records of each patient were individually reviewed. Patients were excluded if they underwent a robot-assisted or laparoscopic procedure, had surgery for benign disease, or had follow-up less than 1 month. The decision to offer a patient open partial nephrectomy was at the surgeon's discretion and based upon patient and tumor characteristics. A subcostal incision was used except in cases of extensive prior intra-abdominal surgery, which necessitated a flank approach. Tumors were removed using an enucleation technique.[18-20] Postoperatively, patients were followed in a urologic oncology clinic at intervals dictated by their pathologic stage.

The Cell Saver blood salvage system (Haemonetics, Braintree, MA) was used in the majority of cases. The decision to request Cell Saver in a particular case was made by the primary surgeon on the basis of individual patient and tumor characteristics. Blood lost during surgery was collected via a suction tube into the Cell Saver system. The decision to autotransfuse was based upon the collected volume; transfusion required collection in increments of either 125 mL (equivalent to a 200-mL blood loss) or 225 mL (equivalent to a 400-mL blood loss) as per the manufacturer's settings. If these thresholds were reached, the salvaged blood was centrifuged and autotransfused. If these minimum volume thresholds were not reached, no Cell Saver blood was transfused.

Intraoperative anesthesia records were examined to determine whether the Cell Saver system was used and whether a Cell Saver transfusion occurred. The need for a perioperative allogenic blood transfusion was also recorded, defined as any transfusion that occurred either intraoperatively or during the hospital stay. If more than 1 tumor was removed during the same operation, the size, Fuhrman grade, and tumor stage were reported as the highest value. All specimens were reviewed by a fellowship-trained genitourinary pathologist. Patients with multiple complications were classified by the highest Clavien grade. Recurrence and survival were determined according to data available on the date of last confirmed follow-up at our institution and censored as of May 1, 2015 or on the date of confirmed death.

Data Analysis

Two patients underwent 2 partial nephrectomies during the study period; in these instances, demographic and recurrence data were reported for each individual procedure. First, we compared patient demographic, clinical, and pathologic characteristics among those who were and were not treated with a Cell Saver transfusion using Fisher's exact, Pearson's chi-square, Mann-Whitney *U* test, or Student's *t* test, as appropriate. Then, we examined the frequency of complications between the two populations. Lastly, we performed a secondary intention-to-treat analysis comparing all cases in which the Cell Saver system was used as a suction device, whether or not a transfusion was given, with those in which Cell Saver system was not used.

Statistics were analyzed using SPSS Statistics 20 (IBM Corp., Armonk, NY). Significance was defined at the $P < .05$ level using 2-sided tests. The study was approved by our institutional review board.

RESULTS

Sixty-nine consecutive open partial nephrectomies in 67 patients were identified that met criteria for inclusion. Of the 2 patients who underwent 2 open partial nephrectomies during the study period, 1 had a Cell Saver transfusion for both operations, and the other had a Cell Saver transfusion for the first but not the second partial nephrectomy. Thirty-three operations (48%) included a Cell Saver transfusion, with a median transfusion volume of 270 mL (interquartile range: 135-405 mL). There were no significant differences between groups for any demographic or pathologic variables (Table 1). Operations including a Cell Saver transfusion were significantly longer (141 vs 108 minutes, $P < .001$), had greater blood loss (600 vs 200 mL, $P < .001$), and had longer median renal ischemia times (15 vs 10 minutes, $P = .03$). The rate of perioperative allogenic blood transfusion was not significantly different between groups (21% vs 8%, $P = .18$).

Sixteen postoperative complications occurred in 13 patients (Table 2). Severe (Clavien III) complications occurred in 6 cases (8.7%), but no Clavien IV or V complications occurred. Median follow-up was 23 months (interquartile range: 8-42 months). One patient who did not receive a Cell Saver transfusion had cancer recurrence; this patient had Fuhrman grade 4 clear cell RCC and a positive surgical margin. No patient experienced metastatic progression or cancer-specific mortality. Two patients died during follow-up, 1 of metastatic breast cancer and another from vascular disease; this proportion was comparably low between groups (3% vs 3%).

Our secondary intention-to-treat analysis did not significantly change any results. Cell Saver was used in 49 of 69 (71%) cases, 16 (33%) of which did not include a transfusion. No clinical or pathologic characteristics were different between groups. Cases in which Cell Saver was used had longer operative times (124 vs 114 minutes, $P = .04$) and greater blood loss (475 vs 200 mL, $P = .001$).

DISCUSSION

To our knowledge, this is the first series to report outcomes of utilizing the Cell Saver intraoperative cell salvage system in patients undergoing open partial nephrectomy. We found that transfusion using the Cell Saver system was not associated with an increased risk of postoperative complications or recurrence. Most importantly, no patient developed metastasis with a median follow-up of 2 years. Although these outcomes are likely due in large part to the generally favorable tumor biology of patients with small renal masses, our data provide no evidence to support the theory that using intraoperative blood salvage can lead to the rapid development of recurrence or metastatic disease.