Characterization and Management of Postoperative Hemorrhage Following Upper Retroperitoneal Laparoscopic Surgery

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Purpose: Surgical paradigms may change in the era of laparoscopic surgery. We evaluated a conservative nonsurgical approach to postoperative hemorrhage following laparoscopic upper retroperitoneal surgery as opposed to the more traditional strategy of reexploring the surgical site.

Materials and Methods: In 911 laparoscopic procedures performed in 8 years we retrospectively identified risk factors and characterized treatment for postoperative hemorrhage.

Results: We considered postoperative hemorrhage to be present when postoperative transfusion was required that could not be accounted for by operative blood loss or another definable cause outside of the surgical field. Red blood cell transfusion was required after 53 procedures (5.8%), of which 34 (3.7%) were done for postoperative hemorrhage. Postoperative hemorrhage occurred only after nephrectomy in 3.3% of cases, after partial nephrectomy in 9.9% and after adrenalectomy in 5.4%. Multivariate analysis revealed a significant association of postoperative hemorrhage with patient age and American Society of Anesthesiologists score (preoperative factors), operative time and splenic injury (intraoperative factors), and gastrointestinal complications and prolonged hospitalization (postoperative factors). Postoperative hemorrhage increased mean hospitalization from 2.5 to 6.4 days. No significant differences in post-hospital recovery were associated with postoperative hemorrhage. Only 4 of the 34 patients (12%) required surgical management of postoperative hemorrhage. All other cases were conservatively managed. Outcome after surgical and conservative management did not differ except postoperative renal complications tended to be more common in the former cases (50% vs 7%).

Conclusions: Most patients with hemorrhage following laparoscopic upper retroperitoneal surgery can be treated with conservative nonsurgical interventions.

Key Words: kidney, laparoscopy, postoperative hemorrhage, nephrectomy, postoperative complications

As urologists turn from open to laparoscopic surgery, paradigms must be re-verified to ensure that they are still applicable in the new era. One such paradigm is treatment for postoperative hemorrhage. In 1912 Halstead stated, "The only weapon with which the unconscious patient can immediately retaliate upon the incompetent surgeon is hemorrhage."[1] Observation, stabilization and/or open exploration are used selectively to address postoperative hemorrhage depending on hemorrhage severity and patient status.[2,3] Specific to urology, some publications describe a frequency of reoperation for postoperative hemorrhage after nephrectomy,[4] adrenalectomy[5] and prostatectomy[6] of 100%, 67% and 57%, respectively. Regarding hemorrhage after radical nephrectomy in Campbell's Urology it is stated, "In most cases, it is best to reopen the wound, evacuate the hematoma and secure the bleeding point."[7] As with open surgery, some patients with postoperative hemorrhage following intra-abdominal laparoscopic surgery require laparotomy. Early reoperative intervention is recommended when excessive intra-abdominal bleeding is suspected postoperatively to decrease morbidity and prevent mortality.

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We reviewed our experience with postoperative hemorrhage after upper retroperitoneal laparoscopic surgery. We characterized the population, identified risk factors and offer evidence that most patients with hemorrhage following laparoscopic upper retroperitoneal surgery may be successfully treated with conservative nonsurgical interventions.

METHODS

In our prospectively maintained database we identified 911 upper retroperitoneal procedures performed from August 1996 through November 2004 by 2 surgeons (JSW and WWR). Missing data were gathered from the medical records retrospectively. Recovery data were obtained by a self-administered SF-12™ and validated recovery questionnaires 2 and 6 weeks postoperatively.[8]

Complications were defined as intraoperative or postoperative. Intraoperative complications were divided into hemorrhage, vascular or organ injury, that is spleen, bowel, liver, diaphragm, kidney and other. Some intraoperative complications were coded as hemorrhage, and vascular and organ injury, if bleeding was significant from that source. In other cases hemorrhage occurred without defined vascular or organ injury and vascular or organ injury could have occurred without hemorrhage. Postoperative complications were divided by system, that is cardiac, renal, pulmonary, nervous, gastrointestinal and wound. For the purposes of

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TABLE 1. *Preoperative demographics*

	No. Pts	Mean Age ± SD*	No. Male (%)*	Mean ASA Score ± SD*	Mean Body Mass Index ± SD*	No. Previous Abdominal Surgery (%)
Nephrectomy	598	51.1 ± 17.0	305 (51)	1.87 ± 0.75	28.1 ± 6.8	215 (36)
Partial nephrectomy	121	57.6 ± 14.6	77 (64)	2.04 ± 0.68	28.4 ± 5.0	38 (31)
Cyst resection	74	45.5 ± 13.2	28 (38)	1.87 ± 0.65	27.2 ± 6.4	31 (42)
Reconstruction	61	37.8 ± 15.1	25 (41)	1.46 ± 0.54	25.5 ± 7.1	18 (30)
Adrenalectomy	37	54.4 ± 12.1	21 (57)	2.28 ± 0.58	30.3 ± 6.7	15 (41)
Other	20	47.1 ± 15.2	8 (40)	2.14 ± 0.66	29.1 ± 7.5	4 (20)
Totals	911	50.6 ± 16.7	464 (51)	1.89 ± 0.72	28.0 ± 6.6	321 (35)
p Value		<0.001	0.005	<0.001	0.0178	0.2912

* Statistically significant.

this analysis we did not distinguish between minor and major complications, and except for hemorrhage we did not consider complications that occurred after patient discharge from the hospital.

Postoperative hemorrhage was defined as the requirement of postoperative red blood cell transfusion that could not be accounted for by operative blood loss, another definable cause outside of the surgical field, such as subcutaneous hemorrhage, gastrointestinal hemorrhage or hemolytic anemia, or hemodilution from perioperative intravenous fluids. It is implicit in our report that hemorrhage occurred from the operative site, although we did not perform imaging confirmation in most patients.

Statistical analysis was performed using ANOVA or the Student t test for continuous data approximating the normal distribution. The Kruskal-Wallis or Mann-Whitney U test was applied if data were not normally distributed. The chi-square or Fisher exact test was used for categorical data. Multivariate logistic regression analysis was done to assess the impact of selected factors on postoperative hemorrhage with $p \leq 0.05$ considered statistically significant. All analyses were performed using commercially available software.

RESULTS

Of the 911 operations there were 598 nephrectomies (simple, radical, donor and nephroureterectomy), 121 partial nephrectomies, 74 cyst resections, 61 reconstructive procedures (pyeloplasty and nephropexy), 37 adrenalectomies and 20 other procedures (retroperitoneal lymph node dissection and exploration, hydrocalix and caliceal diverticulum resection, and renal biopsies). Table 1 reveals some differences among the procedures in terms of preoperative demographics. Table 2 lists perioperative data, of which much also varied by procedure. Of the 911 total procedures postoperative red blood cell transfusion was required after 53 (5.8%), of which 1 was due to hemolytic anemia (reaction to cephalosporin), 2 were due to subcutaneous blood loss and 16 were accounted for by blood loss during operation. The remaining 34 patients (3.7%) were assumed to have postoperative hemorrhage, which was significantly associated with procedure type ($p = 0.0016$), occurring only after nephrectomy (3.3%), partial nephrectomy (9.9%) and adrenalectomy (5.4%).

Imaging confirmation of the presumed retroperitoneal site of hemorrhage was obtained in only a few cases. In these 34 patients mean preoperative hematocrit was 35% (range 27% to 45%), the mean number of red blood cell units transfused was 3.3 (range 2 to 12) and mean hematocrit at transfusion was 23% (range 18% to 30%). Patient 7 with the 12 U transfusion requirement had portal hypertension and underwent retroperitoneoscopic converted to open surgical radical nephrectomy. This patient has been described in a previous publication.[9] Another patient who required 11 U

TABLE 2. *Perioperative data*

	Nephrectomy	Partial Nephrectomy	Cyst Resection	Reconstruction	Adrenalectomy	Other	Totals	p Value
No. pts	598	121	74	61	37	20	911	
No. hemorrhage (%)	20 (3.3)	12 (9.9)	0	0	2 (5.4)	0	34 (3.7)	0.0016
No. route:*								0.006
Transperitoneal	520	100	71	61	28	14	794	
Retroperitoneal	71	21	3	0	9	6	110	
Combined	7	0	0	0	0	0	7	
No. approach:*								<0.001
Standard laparoscopic	181	57	70	59	37	18	422	
HALS	417	64	4	2	0	2	489	
No. operative conversion:*								0.0015
To open	8	1	0	1	2	2	14	
To HALS	7	6	0	0	0	0	13	
None	583	114	74	60	35	18	884	
Mean operative time ± SD (mins)*	227 ± 59	194 ± 56	144 ± 52	229 ± 78	170 ± 48	161 ± 62	213 ± 64	<0.001
Mean estimated blood loss ± SD (ml)*	289 ± 432	379 ± 541	113 ± 199	80 ± 63	354 ± 622	115 ± 123	276 ± 436	<0.001
No. any complications (%):								
Intraop*	74 (12)	7 (6)	9 (12)	3 (5)	8 (22)	0	101 (11)	0.0187
Postop	132 (22)	21 (17)	15 (20)	16 (26)	11 (30)	5 (25)	200 (22)	0.5955
Mean PBRC transfusion ± SD (U)	0.12 ± 0.75	0.26 ± 0.82	0 ± 0	0 ± 0	0.35 ± 1.8	0 ± 0	0.12 ± 0.77	0.0538
Mean hospitalization ± SD (days)	2.7 ± 3.2	2.9 ± 3.7	2.5 ± 2.5	2.4 ± 1.1	2.7 ± 3.6	2.2 ± 1.5	2.7 ± 3.1	0.8625

* Statistically significant.