

Blood loss during laparoscopic radical prostatectomy – is it significant or not?

Sławomir Poletajew, Artur A. Antoniewicz

Department of Urology, Interforest Specialist Hospital, Warsaw, Poland

KEY WORDS

prostate cancer ▶ prostatectomy ▶ laparoscopic surgery ▶ blood loss ▶ blood cell count

ABSTRACT

Introduction. The traditional assessment of blood loss during laparoscopic radical prostatectomy (LRP) is based on the blood volume collected intraoperatively in the suction device bottles. While this method is not perfect, analysis of changes in blood cell count (BCC) resulting from LRP is advisable.

Material and methods. 71 men were submitted to LRP due to prostate cancer in our institution over an 18-month time period. From this group, we isolated 60 men with clinically minimal intraoperative blood loss (<200 ml) and included them into the study. Mean age of the cohort was 62.8 years. We performed standard BCC on the day before and 6 hours after the surgery. At the same time points, we measured creatinine serum concentration and calculated eGFR to avoid the data misinterpretation resulting from impaired renal function in the postoperative period.

Results. Statistically and clinically significant differences regarding all BCC parameters measured pre- and postoperatively were observed. The number of red blood cells, hemoglobin concentration, and hematocrit diminished by 17.5% (4.68T/l vs. 3.86T/l, $p < 0.02$), 17.0% (8.93 mmol/l vs. 7.41 mmol/l, $p < 0.02$), and 17.9% (0.429 vs. 0.352, $p < 0.02$), respectively. Simultaneously, renal function was stable with no significant change in eGFR (82.9 ml/min/1.73 m² vs. 79.09 ml/min/1.73 m², $p = 0.28$).

Conclusions. Standard LRP brings on a significant blood loss. While clinically insignificant, this blood loss seems to be as high as approx. 600 ml based on laboratory findings. BCC seems to be a more accurate method of intraoperative blood loss estimation compared to measurement of blood volume collected intraoperatively in the suction device bottles.

INTRODUCTION

Intraoperative blood loss is one of the most commonly used parameters to assess the safety of surgical procedures. Available data regarding laparoscopic radical prostatectomy (LRP) indicates unambiguously that the surgery is safe, also in terms of blood loss [1, 2]. What is more, reduced blood loss remains one of the crucial advantages of LRP when compared with open radical prostatectomy [3, 4, 5]. Many investigators confirmed all facts mentioned above since 1997 when Schuessler performed the first LRP in history [6].

Mean blood loss during LRP of approx. 250 ml is reported in recent studies enrolling a large series of patients [7]. However, traditionally we base blood loss on blood volume collected intraoperatively in the suction device bottles. Such a method is subjective and imperfect. We already know that both anesthesiologists and urologists tend to underestimate blood loss during open retropubic prostatectomy and that the underestimation is relatively important [8]. The little accuracy of visual estimation of blood loss had been clearly proven by gynecologists and obstetricians [9, 10, 11]. In this setting, we decided to answer the question whether intraoperative blood loss during LRP assessed clinically corresponds with changes in blood cell count (BCC).

The aim of this study was to analyze changes in BCC resulting from LRP and to compare them with clinical blood loss estimation.

MATERIAL AND METHODS

Population

There were 71 men submitted to extraperitoneal LRP due to organ confined prostate cancer in our institution from September 2009 to March 2011. Based on a surgeon's subjective assessment reported in their surgical protocol, we isolated the group of 61 men with clinically minimal intraoperative blood loss, which was defined as loss of less than 200 ml. For the final analysis we included 60 men with full data regarding surgery and laboratory findings in the perioperative period. Mean age of the cohort was 62.8 years.

Intervention

We performed retrospective analysis of medical documentation with special interest in laboratory findings. According to standard management with patients submitted to LRP in our institution, all the group had blood tests performed a day before (test 1) and 6 hours after the surgery (test 2). We registered results of all BCC parameters, creatinine serum concentration and estimated glomerular filtration rate (eGFR) at these two time intervals. Finally, we compared the analyzed laboratory findings obtained in tests 1 and 2. All blood was analyzed in a central hospital laboratory in the same method. An automated hematology analyzer was used for BCC and the colorimetric Jaffe reaction for creatinine serum concentration measurement. Estimated GFR was calculated using the MDRD (Modification of Diet in Renal Disease) formula.

Statistical analysis

Paired t-test was used for comparing results of tests 1 and 2 for each parameter. Normal distribution was confirmed by the Shapiro-Walk test while the equality of variances was assessed using Levene's test before all the t-tests were performed. The differences were considered to be statistically significant when the p-value was lower than 0.02. The measurement results are expressed as mean values and standard deviations.

RESULTS

We noticed statistically and clinically significant differences regarding all BCC parameters measured at the two time intervals. Detailed results are presented in table 1 and figures 1 and 2.

Table 1. Changes in blood cell count resulting from LRP. The measurement results are expressed as mean values and standard deviations

	Test 1	Test 2	Absolute difference	% difference	P value	Reference range
RBC [T/l]	4.68 (0.44)	3.86 (0.47)	-0.82	-17.5	<0.02	4.5-6.0
Hb [mmol/l]	8.93 (0.70)	7.41 (0.81)	-1.52	-17.0	<0.02	8.4-11.0
Hct [%]	42.9 (3.55)	35.2 (4.01)	-7.7	-17.9	<0.02	42-55
WBC [G/l]	7.31 (1.64)	11.8 (3.94)	4.48	61.4	<0.02	4.0-10.0
PCT [G/l]	213.6 (43.1)	155.6 (35.4)	-58.0	-27.2	<0.02	140-320

RBC – red blood cells; Hb – hemoglobin concentration; Hct – hematocrit; WBC – white blood cells; PCT – platelet crit

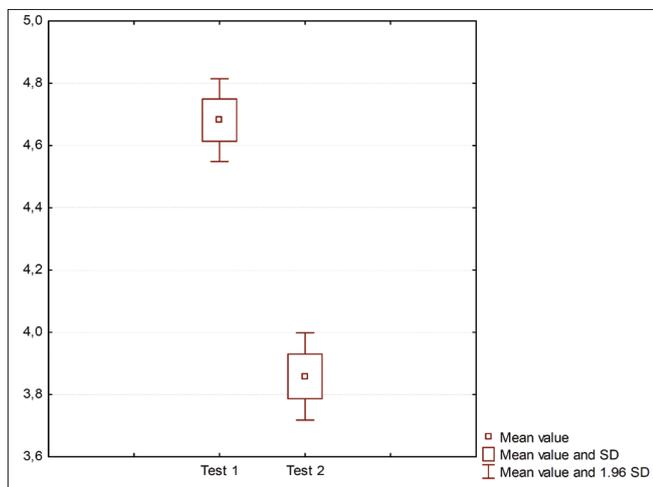


Fig. 1. Changes in the number of red blood cells resulting from LRP.

Simultaneously, renal function, assessed by creatinine serum concentration measurement and eGFR calculation, was stable. Table 2 shows the differences in renal function tests resulting from LRP.

DISCUSSION

Our retrospective investigation was aimed at critical analysis of the value of clinical assessment of blood loss during LRP. To the best of our knowledge, such an analysis has never been done before, while its clinical importance remains obvious.

Based on previous studies we can calculate the effect of blood loss on hemoglobin concentration. Using the same formulas, we can also calculate blood loss when levels of hemoglobin concentration are known. Taking the results of a study performed by Davies et al., we may assess the real blood loss in our group of patients to be as high as 8 ml/kg, hence 600 ml in a typical 75 kg male prostate cancer patient [12]. At the same time, clinically assessed blood loss was calculated by the surgeon to be not more than 200 ml.

This finding highlights an important problem of clinical underestimation of blood loss.

The fact that urologists underestimate blood loss during open prostate surgery was already known [8]. Our study shows discrepancies between clinical estimation and laboratory results using the laparoscopic approach, which occurred to be much more signifi-

cant. While the differences in open prostate surgery do not exceed 30%, we noticed differences of 300% in our group.

Finally, it is also worth remembering that laboratory tests are imperfect. Meunier et al. showed that when assessing blood loss based on a decrease in hemoglobin concentration, we can underestimate it by more than 30% [13]. It means that real blood loss in our group of patients might even exceed 800 ml, hence we found a four-fold clinical underestimation of blood loss. We can summarize that clinical and laboratory methods of blood loss estimation are neither practical nor reliable. This important statement is supported by Schorn's critical review of methods of blood loss measurement [14].

The reason for such important differences between clinical and laboratory estimation of blood loss during LRP should be indicated. In general, bleeding during laparoscopic procedures may be reduced following insufflation of the appropriate cavity and the associated tamponade effect [15-18]. In this setting, venous bleeding is more likely to occur shortly after the procedure than during the surgery. We suppose that visual underestimation of blood loss may result from early postoperative formation of perivesical, perineal, or obturator hematomas, while direct measurement of blood loss does not consider it [19].

Our study has some important limitations. First, it is its retrospective character, which is supported by archival medical documentation. This fact may affect results, however, obtained results are clearly unambiguous. Whether we under- or overestimate the

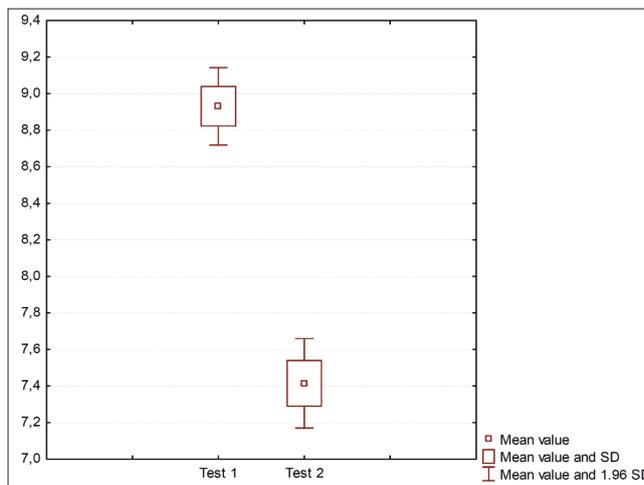


Fig. 2. Changes in the concentration of hemoglobin resulting from LRP.

Table 2. Changes in renal function tests resulting from LRP. The measurement results are expressed as mean values and standard deviations

	Test 1	Test 2	Absolute difference	% difference	P value	Reference range
Creat [mmol/l]	85.4 (16.3)	89.1 (19.1)	3.8	4.3	0.24	54-110
eGFR [ml/min/1.73m ²]	82.9 (18.6)	79.0 (21.4)	-3.9	-4.7	0.28	>90

Creat – creatinine serum concentration; eGFR – estimated glomerular filtration rate

significance of the problem there is no doubt that a significant problem exists.

Second, being a pilot study, this analysis covers only 60 cases of LRP with clinically minimal blood loss. Based on our preliminary results, it may be justified to collect the data prospectively in order to finally confirm our findings.

CONCLUSIONS

Standard LRP prompts significant blood loss. The accuracy of clinical estimation of blood loss during LRP is low. While clinically insignificant, blood loss seems to be as high as approx. 600 ml based on laboratory findings. BCC seems to be a more accurate method of intraoperative blood loss estimation compared to measurement of blood volume collected intraoperatively in the suction device bottles. Our study highlights the importance of BCC in assessing the blood loss during LRP.

Acknowledgements

Results of the study were presented in part during 11th EAU Central European Meeting in Timisoara, Romania on 28-29 October 2011.

REFERENCES

- Guillonneau B, Cathelineau X, Doublet JD, Vallancien G: *Laparoscopic radical prostatectomy: the lessons learned*. J Endourol 2001; 15: 441-445.
- Lein M, Stibane I, Mansour R, et al: *Complications, urinary continence, and oncologic outcome of 1000 laparoscopic transperitoneal radical prostatectomies—experience at the Charite Hospital Berlin, Campus Mitte*. Eur Urol 2006; 50: 1278-1282.
- Ficarra V, Novara G, Artibani W, et al: *Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies*. Eur Urol 2009; 55: 1037-1063.
- Tooher R, Swindle P, Woo H, Miller J, Maddern G: *Laparoscopic radical prostatectomy for localized prostate cancer: a systematic review of comparative studies*. J Urol 2006; 175: 2011-2017
- Hegarty NJ, Kaouk JH: *Radical prostatectomy: a comparison of open, laparoscopic and robot-assisted laparoscopic techniques*. Can J Urol 2006; 13 (Suppl 1): 56-61.
- Schuessler WW, Schulam PG, Clayman RV, Kavoussi LR: *Laparoscopic radical prostatectomy: initial short-term experience*. Urology 1997; 50: 854-857.
- Sultan MF, Merrilees AD, Chabert CC, Eden CG: *Blood loss during laparoscopic radical prostatectomy*. J Endourol 2009; 23: 635-638.
- McCullough TC, Roth JV, Ginsberg PC, Harkaway RC: *Estimated blood loss underestimates calculated blood loss during radical retropubic prostatectomy*. Urol Int 2004; 72: 13-16.
- Stafford I, Dildy GA, Clark SL, Belfort MA: *Visually estimated and calculated blood loss in vaginal and cesarean delivery*. Am J Obstet Gynecol 2008; 199: 519 e1-7
- Gharoro EP, Enabudoso EJ: *Relationship between visually estimated blood loss at delivery and postpartum change in haematocrit*. J Obstet Gynaecol 2009; 29: 517-520.
- Yoong W, Karavolos S, Damodaram M, et al: *Observer accuracy and reproducibility of visual estimation of blood loss in obstetrics: how accurate and consistent are health-care professionals?* Arch Gynecol Obstet 2010; 281: 207-213.
- Davies P, Robertson S, Hegde S, et al: *Calculating the required transfusion volume in children*. Transfusion 2007; 47: 212-216.
- Meunier A, Petersson A, Good L, Berlin G: *Validation of a haemoglobin dilution method for estimation of blood loss*. Vox Sang 2008; 95: 120-124.
- Schorn MN: *Measurement of blood loss: review of the literature*. J Midwifery Womens Health 2010; 55: 20-27.
- Sava J, Velmahos GC, Karaiskakis M, et al: *Abdominal insufflation for prevention of exsanguination*. J Trauma 2003; 54: 590-594.
- Mertens zur Borg IR, Lim A, Verbrugge SJ, et al: *Effect of intraabdominal pressure elevation and positioning on hemodynamic responses during carbon dioxide pneumoperitoneum for laparoscopic donor nephrectomy: a prospective controlled clinical study*. Surg Endosc 2004; 18: 919-923
- Velmahos GC, Spaniolas K, Duggan M, et al: *Abdominal insufflation for control of bleeding after severe splenic injury*. J Trauma 2007; 63: 285-288.
- Eiriksson K, Fors D, Rubertsson S, Arvidsson D: *High intra-abdominal pressure during experimental laparoscopic liver resection reduces bleeding but increases the risk of gas embolism*. Br J Surg 2011; 98: 845-852
- Flordal PA: *Measurement of blood loss in clinical studies*. Eur J Anaesthesiol Suppl 1997; 14: 35-37.

Correspondence

Slawomir Poletajew
Interforest Specialist Hospital
Department of Urology
2, Bursztynowa Street
04-749 Warsaw
slawomir.poletajew@gmail.com
phone: +48 22 473 51 71