Spring 5-5-2011

Comparative Analysis Research on Treatments of Prostate cancer obtaining and comparing results of patients who have received laproscopic, robotic-labroscopic, or cryosurgery, radiation therapy

Huy Nguyen

Comparative Analysis Research of Robotic Assisted Laparoscopic Prostatectomy

By: Jonathan Barlaan; Huy Nguyen
Mentor: Julio Powsang, MD
Reader: Richard Wilder, MD
May 2, 2011

Abstract

Introduction: The goal of laparoscopic prostatectomy is to excise the cancer completely, provide good urinary continence post-operatively, and maintain the ability to have erections after the surgery, if present prior to surgery. Robotic assisted laparoscopic prostatectomy is a procedure performed with the assistance of a surgical robot that provides improved magnified vision in order to help achieve these goals while minimizing surgical incisions. With experience in performing this type of procedure, surgical doctors should be able to reduce operating time, blood loss, and margin error.

Methods: We reviewed the records of 200 patients who underwent treatment between July 2008 and February 2010. The first group of 100 patients ranged from July 2008 to February 2009 and the second group ranged from July 2009 to February 2010. Patients within each group were divided according to their pathological stages (pT2 and pT3) in a chronological time line. The percentages of patients with margin errors were then calculated for pT2, pT3, and an overall combination of pT2 + pT3 for each group. The mean blood lost (in cc) and mean operative time (in minutes) were also calculated within each group. We then created a line graph for mean blood lost and mean operative time against the operative time line according to pT2, pT3, and an overall for both groups. We also took the mean for age; mean Gleason Scores for pT2, pT3, and an overall; percentage of patients with Hernia repair, percentage with PLN dissection for pT2, pT3, and an overall; mean number of length of days stayed post operative; mean number of days until removal of Foley; mean number of days until JP removal; and percentage of patients with incontinence, erectile dysfunction, and stricture within a 1 year period post operative. P-value and correlation (r) were also calculated.

Results: Mean patient age was 61 years with an average Gleason score of 6.64 for pT2 ($p < 0.0001$), 6.97 for pT3 (p-value < 0.0001), and 6.69 for a combination of pT2 and pT3 ($p < 0.0001$). 1.5% of the patients had hernia repair, 7.88% with pT2 had PLN dissection, 33.33% of pT3 had PLN dissection, and an overall of 12.12% had PLN dissection. Patients stayed an average of 2.65 days post-operatively for Group 1 and 2.01 days for Group 2 (P-value = 0.0004). The average time for JP drain removal was about 3.11 days for Group 1 and 1.87 days for Group 2 (P-value = 0.0023). The average time for Foley catheter removal was 17.5 days in Group 1 and 12.7 days in Group 2 (P-value <0.0001). 74.73% of patients were incontinence, 90.71% had erectile dysfunction, and 1.51% had stricture. For group 1, 16.46% of patients with pT2 had margin errors, 44.44% for pT3, and an overall of 21.65%. For group 2, 26.74% of patients with pT2 had margin errors, 57.14% for pT3, and an overall of 31%. The mean blood loss for the first group of patients was 596.28 cc, while the second group had a mean blood loss of 387.37 cc with a negative correlation ($r = -0.24$) between mean blood loss and operative date (P-value = 0.0003). For operative time, the first

group has a mean operative time of 265.89 minutes while the second group had a mean operative time of 224.42 minutes with a negative correlation (r = -0.31) between operative time and operative date (P-value = 0.001).

Conclusion: In this study, there is noticeable decreased in estimated blood lost and operative time for the second group compared to the first group overtime. However, the percent with margin error were unexpectedly higher in the second group compared to the first group.

Introduction

Prostate cancer is the second most common cancer in American men [5]. The cancer behaves in a broad range from being microscopic and well-differentiated to being aggressive with a high likelihood of invasion and metastasis. In determining whether one may have prostate cancer, one should be aware of several signs that may point to prostate cancer. Probably the most common sign is an elevated serum PSA level. This is useful especially when the cancer is asymptomatic. However, a high serum PSA level does not always mean one has a clinically significant cancer. A second method in diagnosing prostate cancer is the digital rectal examination (DRE). Signs for advanced stages of prostate cancer include urinary urgency, nocturia, frequency, and erectile dysfunction [5].

Before a professional diagnosis can be confirmed, a histological examination of the prostate is required. Usually one must have elevated serum PSA levels and an abnormal DRE before undergoing a prostate biopsy. Elevation in serum concentration could be due to malignant prostate tissue or disruption of the prostate-blood barrier by cancerous tissue. A confirmation of one's PSA level is advised before proceeding further to having a prostate biopsy. Even if one has a normal serum PSA level, patients with an abnormal DRE should undergo a prostate biopsy. Abnormalities can include induration, asymmetry, or palpable nodularity of the prostate gland. As with serum PSA levels, patients who do have an abnormal DRE should have further diagnostic tests done in order to rule out prostate cancer [5].

Prostate biopsies can be performed a few different ways. Techniques can range from an ultrasound-guided sextant technique to endorectal coil magnetic resonance imaging technique. Repeat biopsies may be necessary for some individuals whose serum PSA levels remain persistently high despite a negative initial biopsy [5].

In order to measure the extent of prostate cancer, a system is used called tumor, node, metastasis (TNM) staging system. This system only applies to patients that have adenocarcinoma squamos carcinomas. The TNM system acts as a guide for initial therapy describing the anatomical stage of a tumor, the exposure of regional lymph nodes, and the extent of metastasis of the cancer. For the purposes of this study, it would be important to describe the pathological staging of T2 and T3 lesions. The difference between the two stages is that T2 lesions are confined to the prostate while T3 lessions have extraprostatic extension. Cancers may be further organized into prognostic groups based off of anatomical staging, serum PSA levels, and Gleason scores results. The evaluation of regional lymph nodes is also an important test done to estimate prognosis and appropriate treatment and therapy. A pelvic lymph node dissection (PLND) is the standard procedure, which is dependent on the likelihood of the nodes being positive [5].

The treatment being analyzed in this study is robotic-assisted laparoscopic prostatectomy (RALP), which is a minimally invasive approach of radical prostatectomy (RP). RP is an established option

in the treatment of localized prostate cancer. RALP utilizes smaller incisions and increased magnification during the surgery to maximize positive patient outcomes. Advantages of RALP over other forms of RP include shorter hospital stays, quicker recovery, fewer acute complications, and reduce positive surgical margin. The cure and functional recovery of each patient is dependent on the experience of the surgeon. The efficacy of the surgery is measured by the absence of detectable PSA in serum after treatment. There have been increased recurrences in patients whose cancer had vesicle invasion or regional lymph node involvement [4].

The main concerns of quality of life after a RP surgery are urinary incontinence and erectile dysfunction. Although complete incontinence is uncommon, there are usually degrees of stress incontinence. Erectile dysfunction is dependent on patient age, preoperative level of sexual functioning, and whether or not nerve-sparing surgery was used [4].

This study utilizes comparative analysis research to compare patient outcomes of RAP surgeries from two different periods of time: July 2008 to February 2009 and July 2009 to February 2010. The first time period was the initial start of the RALP procedure at the Moffitt Cancer Center and the second time period involves more recent cases with the surgeons having at least one year experience of performing the surgical procedure. After retrieving several different types of patient information from two hundred cases of RALP procedures, analysis of this data would confirm or dispute the hypothesis of a direct correlation between increased experience in performing RALP surgeries and improved patient outcomes. The primary goal of the study was to assess the patient outcomes and find possible correlation or general trends among several variables over time. The application of these findings can be useful for the Moffitt Cancer Center in improving their techniques of RALP and can possibly be used as a presentation of statistical averages to Moffitt Cancer Center patients considering RALP as a means of treatment for prostate cancer.

Methods

Using a program called PowerChart by Citrix, data was obtained from two hundred patient records within the time period of July 2008 and February 2010. Only patients who had received robotic-assisted laparoscopic prostatectomy were reviewed. The dates for the first group of one hundred patients ranged from July 2008 and February 2009, and the second group ranged from July 2009 to February 2010. The specific information extracted from these electronic medical records included, but was not limited to age, operative data, serum PSA level, pathological stage, surgical margin, operative time, blood loss, length of stay, and complications, such as incontinence, erectile dysfunction, and stricture. For patients who returned for follow up visits, additional PSA testing was performed at three month intervals.

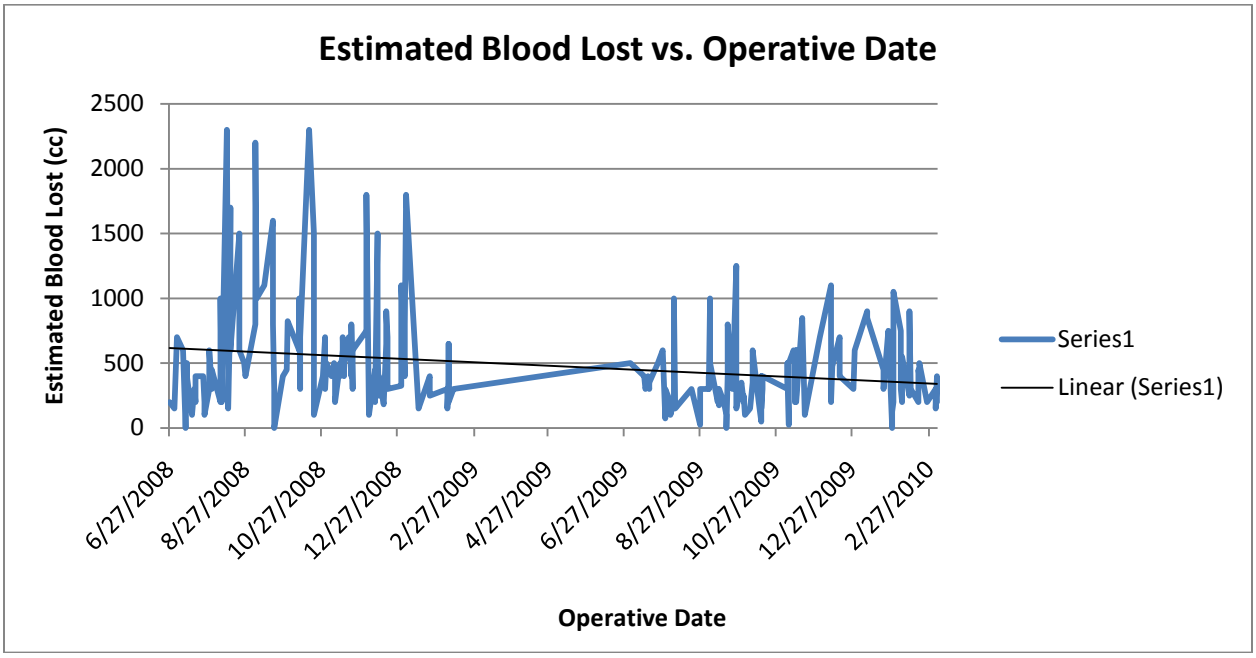
Patients within each group were separated according to their pathological stages and chronologically ordered. These two groups of patients were then analyzed and compared according to the data obtained. For this study, the main focus centered on patients whose cancer was either pathological stages pT2 or pT3, since they were the most prevalent. The percentages of patients with positive surgical margin errors for each group were then calculated for pT2, pT3, and an overall combination of pT2 + pT3. The mean blood lost in cubic centimeters and the mean operative time in minutes was also calculated within each group. A linear graph of mean operative time versus operative date was plotted, as well as a graph plotting mean blood lost versus operative date. In addition to several other calculations were made, such as the mean age; mean Gleason Scores for pT2, pT3, and overall pT2 + pT3; percentage of patients with Hernia repair, percentage of patients with peri-lymph node (PLN) dissection for pT2, pT3, and overall pT2 + pT3; mean number of length of days stayed post operatively for each group, excluding a few outliers that had values of 7 or more days; mean number of days for removal of the Foley catheter in each group; mean number of days for removal of JP drain in

each group; and percentage of patients with incontinence, erectile dysfunction, and stricture within a one year period post operatively.

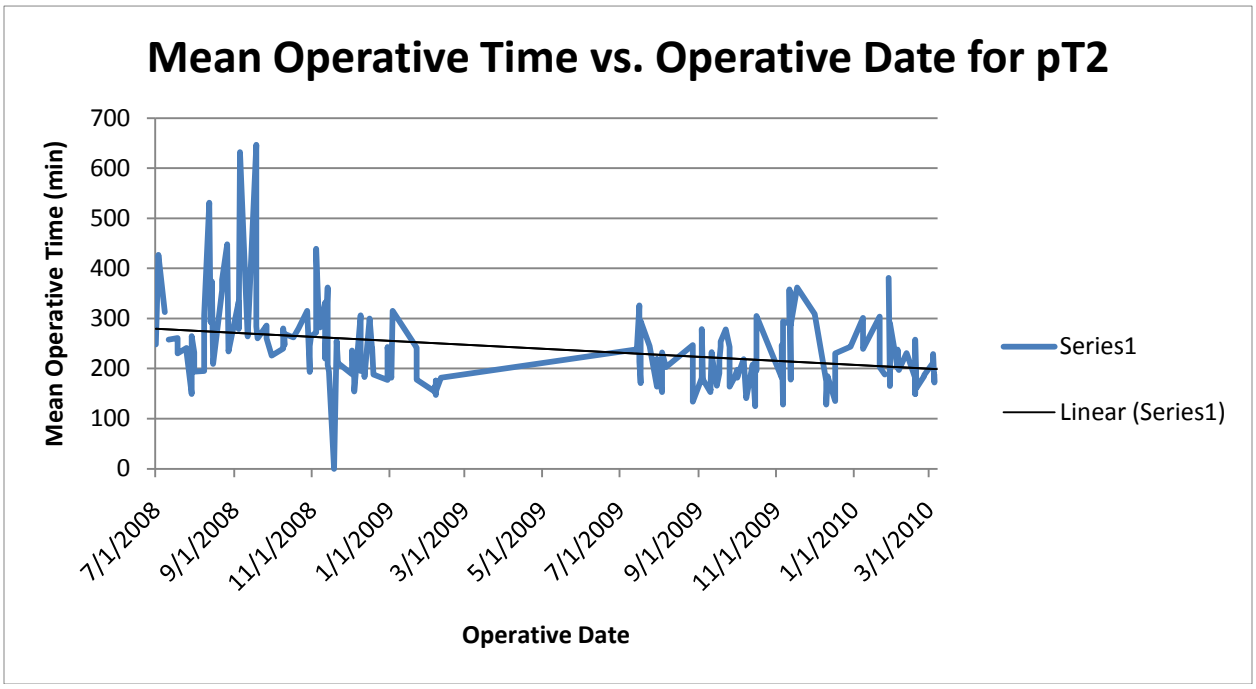
Results

Out of the two hundred patients who underwent robotic-assisted laparoscopic prostatectomy, 165 patients (82.5%) had pathological stage of pT2, 33 patients (16.5%) had pathological stage of pT3 or higher, and the other 2 patients (1%) had no record regarding their pathological stage. The average age of the patients was 61 years with an average Gleason score of 6.4 for pT2 (P-value < 0.0001), 6.97 for pT3 (P-value <0.0001), and 6.69 for a combination of pT2 and pT3 (P-value < 0.0001). 1.5% of the patients had hernia repair, 7.88% patients with pT2 stage had PLN dissection, 33.33% patients with pT3 stage had PLN dissection, and an overall of 12.12% patients had PLN dissection. Patients stayed an average of 2.65 days post-operatively for Group 1 and 2.01 days for Group 2 (P-value = 0.0004). The average time for JP drain removal was about 3.11 days for Group 1 and 1.87 days for Group 2 (P-value = 0.0023). The average time for Foley catheter removal was 17.5 days in Group 1 and 12.7 days in Group 2 (P-value <0.0001). In a one year range post-operatively, 74.73% of patients showed signs of incontinence, 90.71% had erectile dysfunction, and 1.51% had stricture that prevented urinary flow. Within Group 1, 16.46% of patients with pT2 had positive surgical margin, 44.44% for pT3, and an overall of 21.65% for both pT2 and pT3. For the second group, 26.74% of patients with pT2 had positive surgical margin, 57.14% for pT3, and an overall of 31% for both pT2 and pT3. The mean blood loss for the first group of patients was 596.28 cc, while the second group had a mean blood loss of 387.37 cc with a negative correlation (r = -0.24) between mean blood loss and operative date (P-value = 0.0003). For operative time, the first group has a mean operative time of 265.89 minutes while the second group had a mean operative time of 224.42 minutes with a negative correlation (r = -0.31) between operative time and operative date (P-value = 0.001).

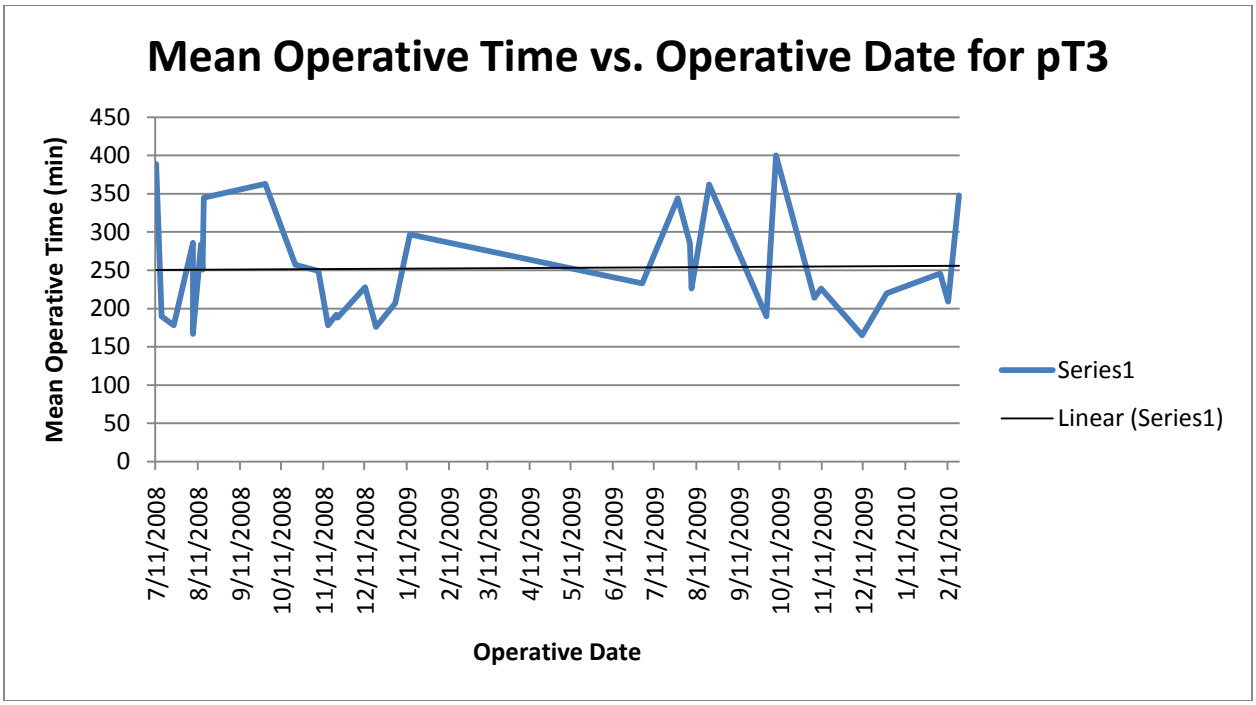
Graphs



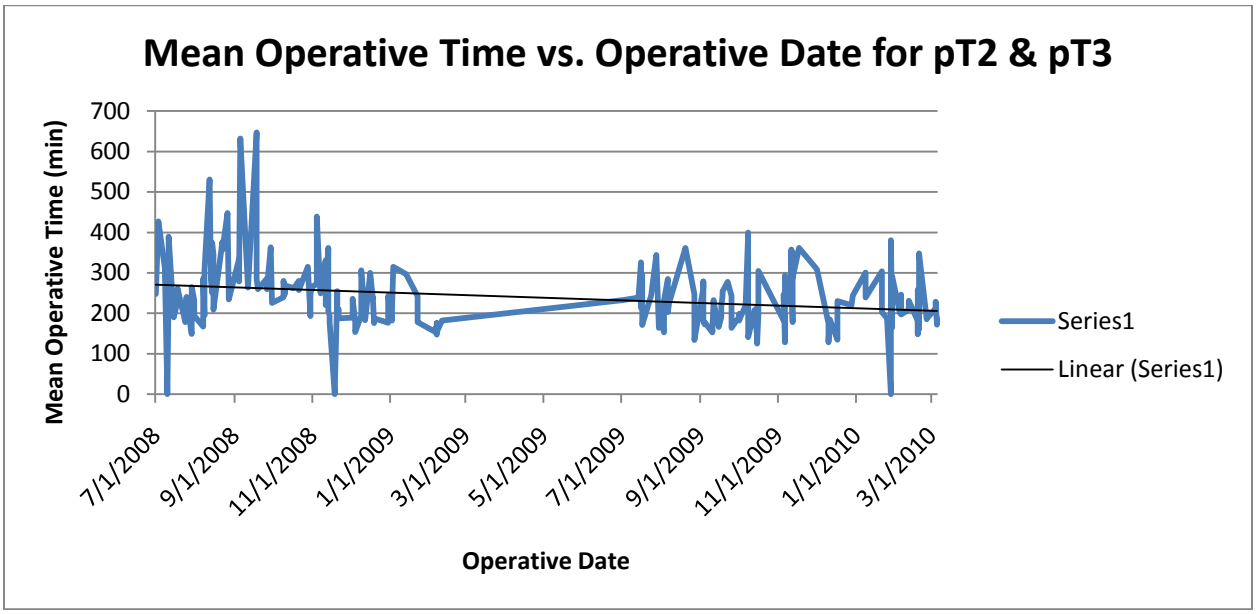
Graph 1. The estimated blood lost of patients from group 1 and 2 plotted over their operative dates. A negative linear regression is shown as time progressed (r = -0.24).



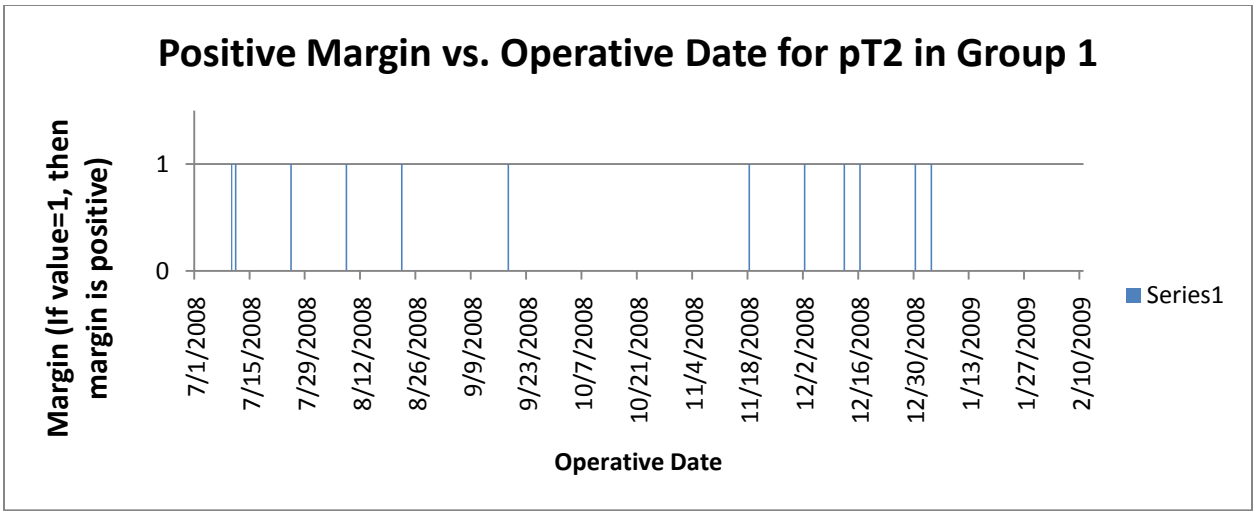
Graph 2. The mean operative time of patients from group 1 and 2 with pathological stage pT2 plotted over their operative dates. A negative linear regression is shown as time progressed (r = -0.30).



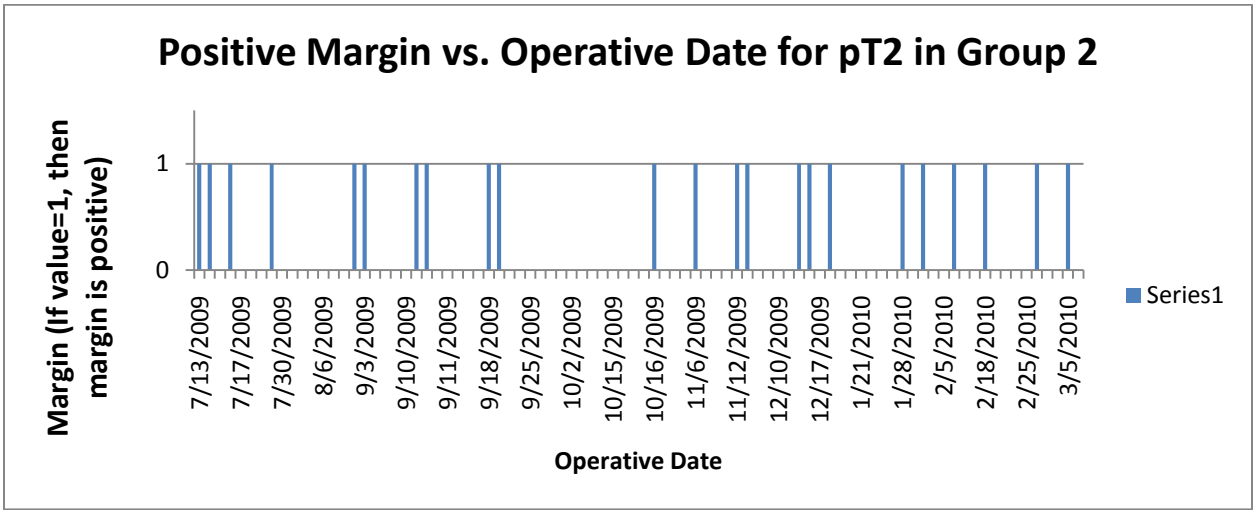
Graph 3. The mean operative time of patients from group 1 and 2 with pathological pT3 stage plotted over their operative dates. There is no significant increase or decrease in operative time over the time line (r= 0.03).



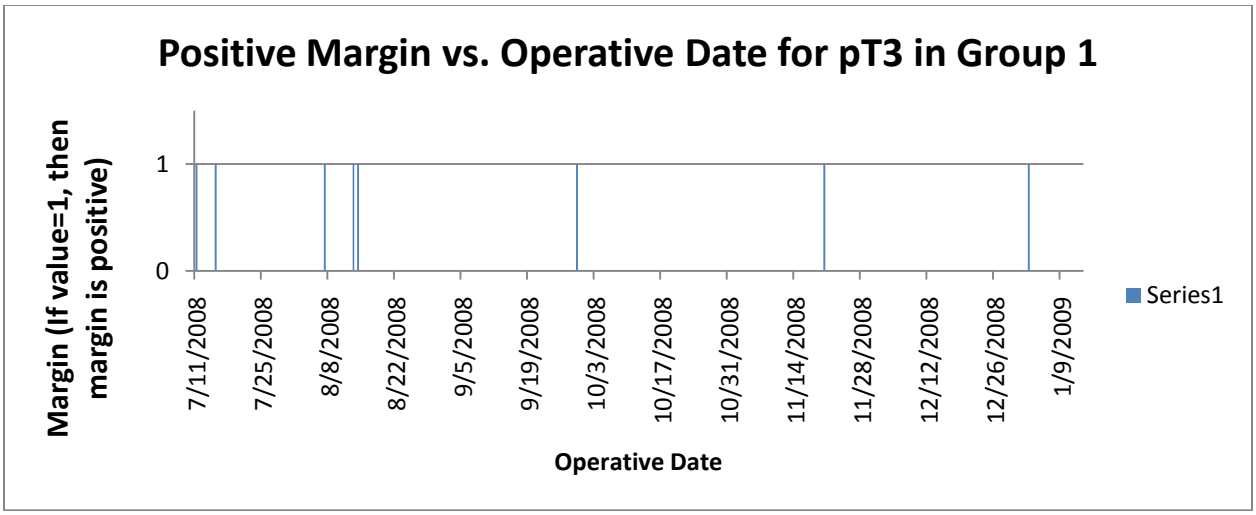
Graph 4. The mean operative time of all patients with pT2 or pT3 from group 1 and 2 plotted over their operative dates. A negative linear regression is shown as time progressed.



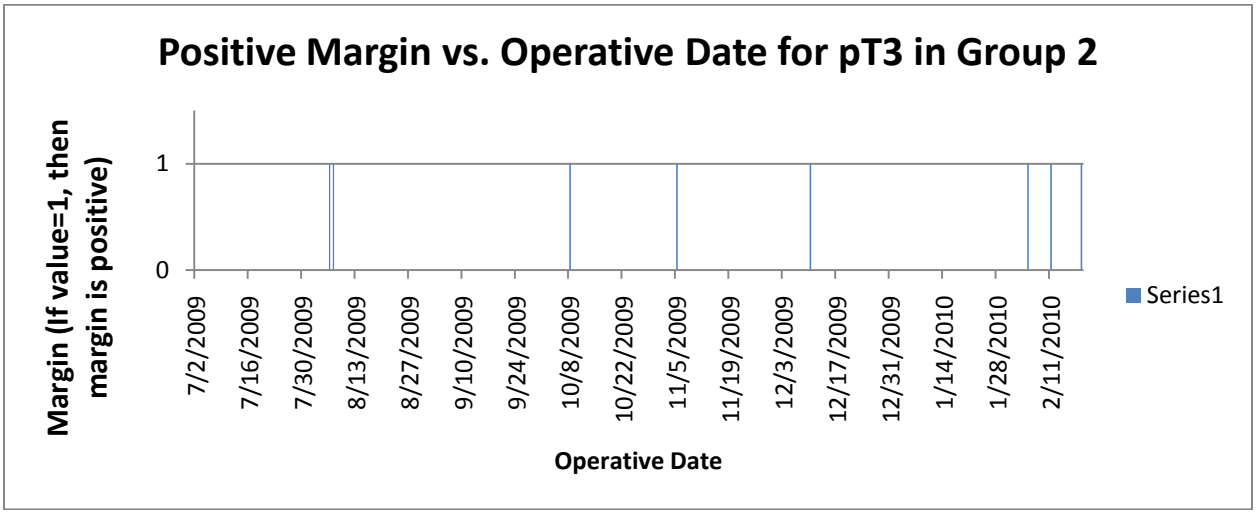
Graph 5. Of the 79 patients with pT2 in Group 1, 13 of them had a positive margin during surgery with no sign of decreased in margin error rate over operative dates.



Graph 6. Of the 86 patients with pT3 in Group 2, 23 of them had a positive margin during surgery with no sign of decreased in margin error rate over operative dates.



Graph 7. Of the 18 patients with pT3 in Group 1, 8 of them had a positive margin during surgery with an apparent decrease in margin error over operative date.



Graph 8. Of the 14 patients with pT3 in Group 2, 8 of them had a positive margin during surgery with an apparent increase in margin error rate over operative date.

Conclusion

After reviewing over 200 patients who underwent robotic assisted laparoscopic prostatectomy, 82.5% of the patients had pathological stage of pT2 where the tumor is still confined to the prostate. 16.5% had pathological stage pT3 or higher where the tumor had already extended through the prostatic capsule or invaded adjacent structures such as pelvic wall, rectum, or levator muscles. The last 1% were unaccounted for which were due to cancellation of operations. Patients with pT2 had an average Gleason score of 6.4 (p-value < 0.0001) compared to a higher Gleason score of 6.9 (p-value < 0.0001) for patients with pT3. This is reflective of the fact that pT3 is a more severe and later stage of prostate cancer, thus a higher number of patients will show a primary or secondary grade 4 with a greater loss of normal glandular structure. In general, most patients with prostate cancer will have a primary or secondary grade of either 3 or 4 and an overall grade of either 6 or 7 [3]. There were only a few cases where patients had an overall grade of 8, and there were no cases that had an overall grade of 9.

Compared to 7.88% of patients who also underwent pelvic lymph node dissection (PLND) with their robotic assisted laparoscopic prostatectomy, a higher 33.33% of patients with pT3 underwent PLND since they are at a higher risk of cancer progression and recurrence compared to pT2. This allows doctors to better evaluate the need for adjuvant therapy and other risks [2]. A rare 1.5% of the patients also had their hernia repaired.

When the data from Group 1 and 2 were compared, there was a noticeable decrease in number of days stayed post-operatively (2.65 days down to 2.01 days; p-value $= 0.0004$), number of days for JP drain removal (3.11 days down to 1.87 days; p-value $= 0.0023$), and number of days for Foley catheter removal (17.5 days down to 12.7 days; p-value < 0.0001). There was also a significant decrease in mean blood loss versus operative date between the two groups. Group 1 has a mean blood loss of 596.28 cc while Group 2 had a mean blood loss of 387.00 cc (p-value $= 0.00003$). Graph 1 shows a negative line of regression with correlation of $r = -0.24$ between the estimated blood loss for the two groups against operative dates. For mean operative time, Group 1 had a mean operative time of 265.89 minutes while Group 2 had a mean operative time of 224.42 minutes (p-value $= 0.0001$). Graph 4 shows a negative line of regression with correlation of $r = -0.31$ between the mean operative time for both groups (pT2 + pT3) against operative dates.

When the data is analyzed separately between pT2 and pT3 stages, Graph 2 shows that there is a negative line of regression with correlation of $r = -0.30$ between the mean operative time for pT2 in both groups against operative date. However, there was no apparent difference between operative time and operative date for pT3 groups ($r = 0.03$). A decrease in number of days stayed, JP drain removal, Foley catheter removal, mean operative time, and mean blood loss can reflect upon an improvement in surgical and post care treatments. Thus, values can vary depending on the experience of the medical surgeon and staff. It should also be taken into consideration that there is a limit to how much surgeons are able to reduce their operative time or reduce the mean blood loss during surgery. This could also explain why there is no decrease in operative time over operative date for patients with pT3 in Graph 3.

For pT2 cases in Group 1, the number of cases that had positive margin during surgery is depicted in Graph 5. There was no apparent sign of increase or decrease over time. In Group 2, the same observation applies as shown in Graph 6. However, it is important to note that overall there were an increased number of cases with positive margin from Group 1 to Group 2. For pT3 cases in Group 1, there was an apparent decrease in surgical margin error as displayed in Graph 7. In Group 2, the rate actually had an apparent increase as shown in Graph 8. These comparisons of positive margin can help surgeons decide whether the approach or technique being taken during surgery needs to be improved or not. This can be a challenging balancing act since the goal is to remove the cancerous tissue and surrounding tissue, but to leave enough of the nerves to prevent any complications [1]. In this study, it is safe to conclude at the least that there was not an improvement in terms of errors in surgical margin.

Patients that underwent robotic assisted laparoscopic prostatectomy can usually expect to face some post surgical problems such as urinary incontinence, impotence, and stricture. In this study of 200 patients, within one year after the surgical date 90.71% of the patients had mild to severe erectile dysfunction, 74.73% had some degree of incontinence, and a rare 1.51% had stricture that prevented urinary flow. Yet of the 90.71% that had mild to severe erectile dysfunction, there was an unknown number of these patients who may have already had erectile dysfunction pre-operatively. Also, erectile dysfunction and incontinency can also occur due to older age or intercurrent diseases, such as hypertension, cardiovascular disease, and diabetes [4]. Thus, the actual number of patient cases with erectile dysfunction and incontinency after surgery may not have been caused by the surgery itself.

References

1. Beard, C., Genega, E., and Wagner, A. Positive surgical margins following radical prostatectomy. Harvard Medical School + Harvard Health Publications: Prostate Knowledge. 2011, Apr. <http://www.harvardprostateknowledge.org/positive-surgical-margins-following-radical-prostatectomy>.

2. Breyer BN, Greene KL, Dall'Era MA, Davies BJ, CJ Kane. Pelvic Lymphadenectomy in Prostate Cancer. Prostate cancer Prostatic Dis. 2008; 11(4):320-324

3. O'Dowd GJ, Veltri RW, Miller MC. The Gleason Score: A significant Biologic Manifestation of Prostate Cancer Aggressiveness on Biopsy. Prostate Cancer Research Inst 2001. www.prostate-cancer.org

4. Klein EA. Overview of Treatment for Clinically Localized Prostate Cancer. UpToDate, Inc. June 18, 2010.

5. Kantof PW, Taplin ME. Clinical Presentation, Diagnosis, and Staging of Prostate Cancer. UpToDate, Inc. March, 19, 2010.