

Can anastomotic urinary leakage in robotic prostatectomy be considered as a marker of surgical skill?

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Introduction The study was conducted to analyze whether the anastomotic urinary leakage (AUL) rate in robot-assisted radical prostatectomy (RARP) can be considered as a marker of surgical skill.

Material and methods Post-operative cystograms taken after RARP, performed between 2006 and 2016 at a third-level university urology center, were prospectively collected. Cystograms were scheduled for all patients on post-operative day 6, but were performed over a range from days 4 to 10 (median 6). In cases of mild, moderate or excessive AUL (according to Han's classification), catheters were maintained; in the other cases, they were removed.

Results Data from 1366 consecutive patients undergoing RARP were collected. The incidence of AUL at first check-up was 18.1%, with a descending trend when RARP were performed by the same surgeon. Evaluating the influence of differing technical modifications on leakage, the AUL rate was significantly lower after the introduction of posterior reconfigurations and a single posterior stitch. The introduction of barbed sutures was initially associated with an increase of leakage, but only in the first year.

Conclusions This study describes the effect of increasing experience and technical modifications in RARP on the AUL rate in a third-level university Italian center over a 10-year period; by stratifying data, we demonstrated a strong correlation between robotic surgical skill and AUL rate, which can therefore be used as an indicator of surgical proficiency.

Key Words: radical prostatectomy ↔ robotic prostatectomy ↔ urinary leakage
↔ learning curve ↔ barbed suture

INTRODUCTION

Over the last 10 years, the introduction of robotic surgery has progressively changed the surgical management of patients with prostate cancer, reducing the invasiveness of radical prostatectomy and improving outcomes [1]. During the same period, new kinds of sutures, such as those with barbs, and consequently novel surgical techniques, were introduced.

One of the most significant improvements has been described for vesico-urethral anastomosis (VUA), not only in terms of reduction of urethro-vesical stricture, but also considering the quality of anastomosis.

A logical consequence has been a reduction in the anastomotic urinary leakage (AUL) rate, a common short-

term complication of radical prostatectomy, with an incidence of 0.3–15.4% [2, 3]. However, few works have focused on the effect on AUL when various approaches and surgical techniques are compared.

Interestingly, the AUL rate may be considered as an indicator of acquired surgical skill, useful in monitoring the learning curve and in evaluating the effect of various technical modifications in robot-assisted radical prostatectomy (RARP) technique. This has never been examined before.

The aim of our study was therefore to analyze the trend of AUL rates in robot-assisted radical prostatectomy (RARP) over the last 10 years in a third-level university center, according to various parameters.

MATERIAL AND METHODS

Data were collected prospectively from post-operative cystograms after RARP was performed between January 2006 and December 2016 in our third-level urology center. All RARP procedures were performed with the Da Vinci Surgical System (Intuitive Surgical™, Sunnyvale, CA, USA).

Although RARP procedures were performed by five surgeons, until 2009 they were all carried out by the same urologist. In all RARPs from 2006 to 2010, a double-direction suture according to the Van Velthoven technique [4] was used, starting from 6 o'clock.

As from 2011, an additional first single 2/0 monofilament stitch was placed at 6 o'clock, and then a Van Velthoven suture again starting from 6 o'clock. Until 2014, 2/0 monofilaments were used; later, anastomosis was performed with bidirectional 3/0 monofilament barbed sutures (Assut®, Italy). In all procedures, VUA was performed over a 20 Ch Folatex catheter.

In cases of posterior reconstruction, Rocco's stitches were rarely used until 2011; since that year, reconstruction was carried out by placing two stitches in Rocco's fashion [5] or, still more recently, with the complete reconstruction of the posterior urethral support (CORPUS) technique [6].

Cystograms were scheduled for all patients on post-operative day 6, but were performed in a range from days 4 to 10 (median 6). Up to 200 ml of contrast media were instilled into the bladder under gravity. Films were taken with antero-posterior and oblique views, allowing identification of any anastomotic leaks posterior to the bladder. There are various grades of AUL severity: leakage is usually classified as minor, moderate or severe, and also according to the extent of extravasation in relation to the anastomosis [7, 8].

According to Han [9], extravasation was classified as follows: none, a plication abnormality, mild, moderate and excessive. "A plication abnormality" was defined as a small linear out-pouching of the contrast at the VUA site, interrupting the urethral wall, but without evidence of extravasation outside of the urethra; according to Berlin et al. [10], this was considered abnormal, but did not reflect urinary leakage. In our series, the catheter was removed in cases of no evidence of leakage (no AUL) or if a plication abnormality had occurred. In cases of mild urinary leakage, the catheter was removed; the urethral catheter was repositioned when leakage increased during the voiding cystographic phase. In cases of moderate or excessive AUL during the filling phase, the catheter was left in place for a further 3–7 days and the cystogram was repeated, to rule out persistent leakage. Persistent cases were managed with prolonged cath-

eter drainage, cystograms being repeated until there was no evidence of leakage or until day 30.

Statistical analysis was performed with MedCalc® software version 16.8. The chi-square test or Fisher's exact test were used for categorical variables. A two-sided $p < 0.05$ was considered statistically significant.

RESULTS

Data were collected from 1366 consecutive patients undergoing robot-assisted radical prostatectomy. Indications for RARP were the finding of clinical, locally confined prostate cancer.

The incidence of cystographic leaks at the first check-up (median post-operative day 6) was 18.1%. Stratifying the results by year, a reduced trend in anastomotic urinary leakage appeared (from 31.6% to 10.8%, $p < 0.005$) (Figure 1).

Considering all patients, 90.8% (1240 cases) had the urinary catheter removed after the first check-up, 5.6% (77 patients) after the second, and 2.9% (39 cases) after the third; in 0.7% (10 patients) the cystograms showed AUL at the 4th or 5th checks.

In order to evaluate the influence of posterior reconstruction on the AUL rate, we compared the results from 2010 and 2011 (the years when systematic posterior reconstruction was introduced in our series). The AUL percentage was significantly lower ($p = 0.0003$) in 2011 (9.7%) than in 2010 (28.2%).

Considering only RARPs performed in 2015–2016 (267 cases), we stratified cystogram outcomes according to the posterior reconstruction technique: the CORPUS technique was used in 52.8% of patients (141 cases) and Rocco's technique in 126 (47.2%).

An AUL was demonstrated in 5.8% of the CORPUS group (8 cases), compared with 6.4% (17 patients) in the Rocco group ($p = 0.035$).

In order to try to identify the pure impact of skill on the AUL rate (Figure 2), we first selected the cases from 2006 to 2008 (carried out by the same urologist) demonstrating a significant trend (from 31.6% to 21.7%, $p < 0.05$); then, we considered only the cases performed by in the last 3 years by the same surgeon (FDM) using the CORPUS technique. In this group of patients, we demonstrated a decreasing trend in the percentage of AUL (from 9.3 to 2%). The introduction of barbed sutures (year 2014) was initially associated with an increase of leakage (from 3.2% to 13.5%), but only in the first year.

DISCUSSION

In our experience, the various approaches to cases of radical prostatectomy confirms the general trend appearing after the introduction of robotic surgery,

with a progressive increase in minimally invasive approaches, as shown in the literature [11].

Our robotic learning started in April 2005, when the da Vinci system was first introduced to our department: in order to reduce the influence of the first few months of robotic experience, which might represent a confounding bias, we decided to exclude the year 2005 from this study.

Although various experiences have demonstrated that early removal of the catheter [12], even without cystograms, is a safe and cost-effective type of management, we decided to maintain the indications for cystograms in the first post-operative days, because a hidden AUL is one of the most important VUA-related complications of RARP: it prolongs catheterization time, may cause peritonitis, and the ileus requires bowel rest and parenteral nutrition, as well as image-guided drain placement [13].

In our study, we used the AUL rate to describe the robotic learning curve of surgeons working in a center with long experience of open prostatic surgery. Achieving a watertight VUA requires expertise in suturing, and this is apparent in the higher incidence of AUL in the first RARP series and its decrease later on. When interpreting the fluctuation of AUL rates in the first few years, it is important to recall that, in the first three years, all RARPs were performed by the same urologist in the first part of his learning curve: a progressive reduction in the leakage rate became clear, confirming that AUL can be used of a marker of skill. A rotation of surgeons with differing levels of expertise, even with skilled mentors, occurred after 2009. Although several surgeons have varying degrees of skill, in this study we demonstrated the absolute trend of skill in robotic surgery. The analysis of AUL rate referred to two single-operator series confirms the trend.

To date, several techniques have been described to perform VUA, including single stitches, and interrupted or running suture anastomoses. However, one of the main problems is the loss of tension due to the loosening of the suture.

In order to optimize VUA, many surgeons have started to use unidirectional barbed sutures, which allow knotless sutures with resistance to slippage and improved efficiency, especially in the case of tissues under tension [14]. However, the literature also reports the opposite regarding the effect of barbed sutures on the AUL rate: Williams et al. [15] reported more frequent cystogram extravasation with longer catheterization times, and Abdul et al. [16] recommended barbed sutures during RARP, resulting in a lower incidence of AUL. A recent meta-analysis showed a similar rate of AUL with barbed or conventional sutures [17].

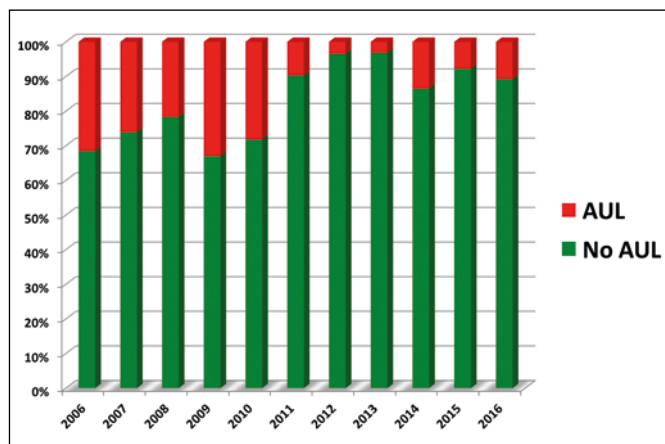


Figure 1. Percentage of Anastomotic Leakage (red) and Non-Leakage (Green) in present series. AUL – Anastomotic Urinary Leakage; No AUL Non – Anastomotic Urinary Leakage.

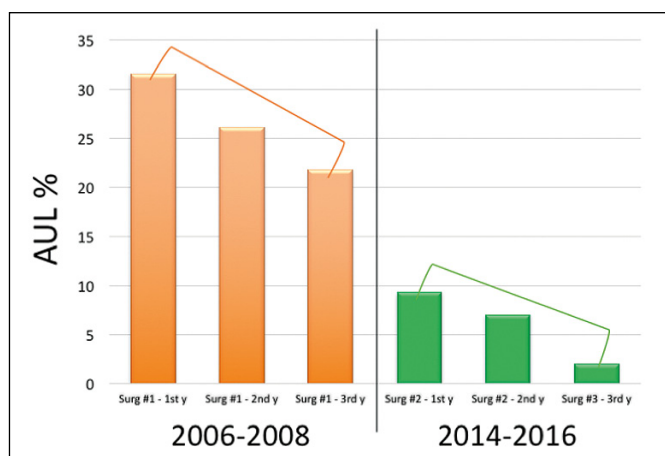


Figure 2. Percentage of Anastomotic Leakage after robot-assisted radical prostatectomy in two single-operator series. AUL – Anastomotic Urinary Leakage

In our series, there was an increase in the AUL rate after the introduction of barbed sutures (2014): this may have been due to the effect of the learning curve in positioning the suture, since progressive tensioning, already not easy even for an experienced surgeon, is crucial. This point was confirmed by the decreased AUL rate in the same group with increasing surgical skill, and demonstrated in the following year (2015, from 13.5% to 7.8%).

A recent meta-analysis [18] focusing on the use of unidirectional barbed sutures to perform anastomoses reported an AUL percentage of 7.08%, comparable with our rate (7.8%). As reported by many authors [19, 20], VUA is definitely facilitated after posterior reconstruction, resulting in a significant decrease in anastomotic leak rates in our series during the evaluation period: since the introduction

of posterior reconstruction in 2011, a progressive reduction in AUL has been apparent.

The meta-analysis of Li et al. [18] demonstrated the effect of posterior reconfiguration on AUL rates, with a decrease in leakage from 9.93% to 2.77%.

In our series, the type of reconstruction does influence the AUL rate, confirming the role of CORPUS technique in the support of the urethro-vesical anastomosis.

The potential limitations of our observational study include not having evaluated the role of intra-operative parameters (e.g., size of bladder neck, amount of blood loss) and different surgeons with different degrees of skill. This last aspect may in fact represent a strength, because it describes ten years of work by a urological team composed of several surgeons with various types of proficiency, in which (after the first 3 years) the more experienced are mentors to the less skilled.

Other strengths of our study include its prospective nature, the large number of cases treated over a 10-year period, and all outcomes evaluated by the same team. This study also describes the percentages of AUL after RARP over a very long period, in order to demonstrate both the trend of learning curves and the effects of various techniques, materials and methods which have become available over the last decade (Figure 3).

CONCLUSIONS

This study describes the effect of increasing experience and technical modifications in robot-assisted radical prostatectomy (RARP) on the anastomotic urinary leakage (AUL) rate in a third-level university Italian center over a 10-year period; stratifying data, we demonstrate a strong correlation between

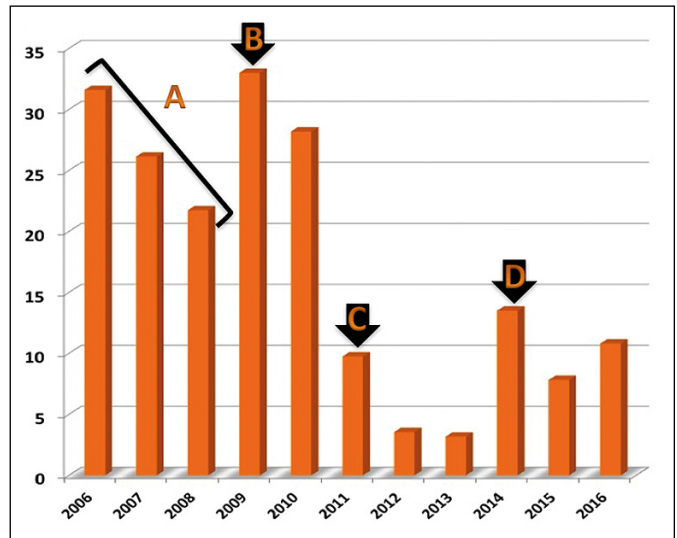


Figure 3. Percentage of Anastomotic Leakage after robot-assisted radical prostatectomy (RARP) over 10 years, with specific markers. A – RARPs performed by same surgeon; B – Surgeons with different levels of expertise; C – Introduction of posterior reconfiguration in all patients; D – Introduction of unidirectional barbed suture for anastomosis.

robotic surgical skill and AUL rate, which can thus be used as an indicator of surgical proficiency.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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