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Urinary Continence After Robot-Assisted Radical Prostatectomy: A Systmatic Review

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***Abstract*—Malignant neoplasm of the prostate is a highly prevalent ailment and its surgical treatment, even with minimally invasive techniques, still produces high rates of various side effects, such as urinary incontinence. This article presents a systematic review of the literature on the occurrence of urinary incontinence after robotic-assisted radical prostatectomy, seeking to define the main predictors and factors described as responsible for incontinence and their relevance. The review covers the records obtained from the Pubmed, Cochrane, Lilacs and Embase databases, published in the past 10 years, using as search terms robotic prostatectomy, urinary continence, trifecta, pentafecta and functional results. All the techniques of prior anatomic reconstruction are beneficial for early return of urinary continence.**

***Index terms*— Functional Results, Functional Outcomes, Robotic Prostatectomy, Urinary Continence, Urinar Incontinence.**

I. INTRODUCTION

Prostate cancer is the most common malignant neoplasm diagnosed in men and the second most common cause of mortality in industrialized countries [1]. Urinary incontinence is the most prevalent complaint after robot-assisted radical prostatectomy (RARP), with rates varying from 4 to 31% [2].

RARP is performed in nearly all countries. Although the rate of urinary incontinence after RARP is lower than for laparoscopic radical prostatectomy (LRP) and open radical prostatectomy (RP), it is still a major problem [3].

Studies with a good level of evidence are rare. In this respect, Ficarra, after selecting more than 10,000 articles comparing the results of open radical, laparoscopic and robotic prostatectomy, only found 37 considered suitable for inclusion in his systematic review [3]. The first study showing a statistically significant advantage of RARP in comparison with LRP and RP in terms of continence 12 months after surgery was published only in 2012 [2].

A non-randomized prospective study comparing two consecutive case series showed that RARP provided an earlier return of continence (16 days x 46 days, p = 0.008), and that RARP is an independent predictor for continence recovery time in a multivariate analysis [4]. This recovery time is an important factor for quality of life. A more recent study showed that when this occurs within 30 days after surgery, there is a significant gain in quality of life, according to the results of applying King's health questionnaire [5].

Because of the relative lack of previous surveys, this article reports the results of a systematic literature review analyzing the occurrence of urinary incontinence after robot-assisted radical prostatectomy.

II. MATERIAL AND METHOD

We performed a systematic literature review about urinary incontinence after robot-assisted radical prostatectomy, comparing all kinds of maneuvers that preserves the anatomical structures and those that make a reconstruction or reinforcement of them, considering and summarizing the evidence in line with the eligibility criteria of the Cochrane Library [6]. We made no contest about age, ethnical or religion groups and selected papers only written in the English language. The study covered articles listed in the Pubmed (http://www.ncbi.nlm.nih.gov/pubmed), Lilacs (http://lilacs.bvsalud.org/), Cochrane (http://www.cochranelibrary.com/) and Embase (http://www.elsevier.com/solutions/embase-biomedical-research) databases, using as search terms robotic prostatectomy, urinary continence, trifecta, pentafecta and functional outcomes. This search was done until December 2015, using only the following limits: humans, male and publication date from June 2010. Initially, this combination revealed 263 articles. After a new selection of articles that really addressed continence in robotic radical prostatectomy, this number declined to 118. Of these, only four had evidence level I or II and were published in the past five years. All papers were reviewed separately by the two authors (F.L. and L.F.) and any discrepancy solved in an open discussion. The 2011 level of evidence was used to distinguish the articles: systematic review of randomized trials (level 1); randomized trials or observational studies with dramatic effects (level 2); nonrandomized controlled cohort/follow-up studies (level 3); case series, case-control studies, or historically controlled studies (level 4); and mechanism-based reasoning (level 5) (http://www.cebm.net/index.aspx?o=5653).

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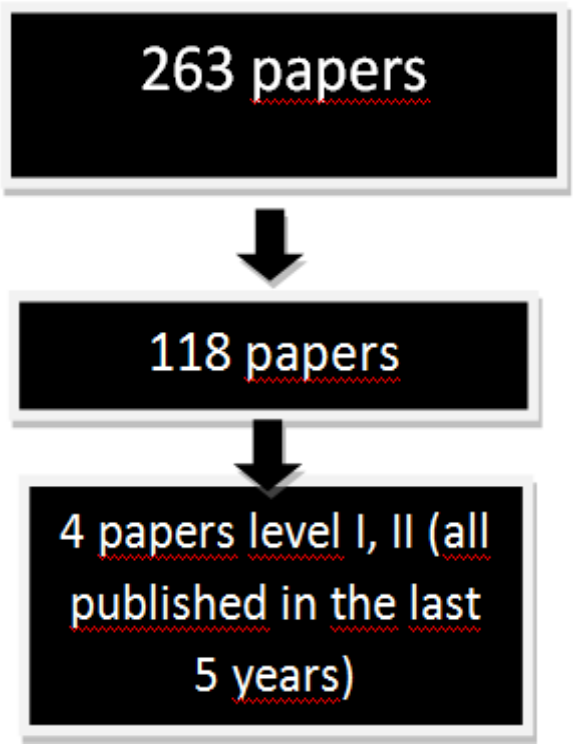

In the review, we sought to define the main predictors and descriptive factors responsible for urinary continence after robotic radical prostatectomy and their relevance to clinical practice [7]. We also performed an update of the postoperative systemic review and meta-analysis performed in 2012 by Ficarra and colleagues [2] about surgical modifications to promote urinary control. These modification techniques can be divided into three groups, according to the work of Kojima and colleagues [5]: preservation, reconstruction and reinforcement of anatomical structures.

III. PREOPERATIVE CONTINENCE STATUS

This status should always be evaluated, because many patients can be idenified as incontinent for a wide range of reasons when applying the EPIC questionnaire before surgery.

IV. PREDICTIVE FACTORS

A systematic review published in 2012 [8] found the following preoperative predictive factors for continence: urethral length, as determined by nuclear magnetic resonance; age; body mass index (BMI); surgeon's experience; neural preservation; and prostate size.

A study involving retrospective analysis of data collected prospectively [9], in a cohort of patients divided into six groups (large prostates, high BMI, high age, salvage prostatectomy, bladder neck procedures prior to RARP and none of these risk factors) revealed a significant difference between the group without any of these risk factors and the group of patients that had undergone previous bladder neck procedures, with continence rates of 95.1% vs. 51.3% one year after surgery, respectively ($p < 0.001$).

Retrospective analysis of prospectively collected data identified 3,362 men who had minimum of 1-year follow-up after robotic prostatectomy between January 2008 and December 2012. The patients were divided in 6 groups according to age > 70, BMI > 35, salvage procedure, prior bladder neck procedure, prostate weight > 80g and finnaly a group without any risk for continence. There were statistical diference only between the salvage group and the patients with no risk. ($p > 0{,}001$) [10].

Tewari [11] analyzed 50 consecutive RARP cases with preservation of the puboprostatic ligaments and their reattachment on the anterior face of the urethrovesical anastomosis, minimal distal dissection of the endopelvic fascia, preservation of the puboperineal muscle, urethrovesical anastomosis without leakage, reconstruction of the tendinous arch and selective suture of the prostatic venous plexus, and compared them with 50 cases without those precautions. The results indicated substantial improvement in terms of early return of continence with adoption of these precepts (62% vs. 43% continence six weeks after catheter removal and 88% vs. 54% 12 weeks afterward).

A. Prostate Size

Another study involving retrospective analysis of data collected prospectively with records on 219 men submitted to RARP in Japan showed that the prostate size did not affect return to continence [12].

B. BMI

The excess of adipose tissue in the pelvis of obese patients, as well as the higher rate of narrow pelvis in these patients, can pose a challenge even to the most experienced surgeons. There are only retrospective studies comparing robotic prostatectomy in patients with BMI lower than or greater than 30, as described in the meta-analysis carried out by Xu and colleagues [13], who selected 13 studies covering a total of 6,622 patients. They found worse functional results in the obese patients.

C. AGE

Gupta and colleagues [14] conducted a retrospective cohort study with prospective collection of data on 150 patients who had undergone RARP and verified that the time for return of continence was associated with age, occurring earlier in younger individuals.

Greco and colleagues [15] also carried out a retrospective study involving prospective collection of data to evaluate age-related continence return in patients submitted to RARP. They found significantly lower continence rates in men older than 70 years six months after surgery, but equivalent levels to those of men younger than that 12 months after surgery. The same pattern was found by Mendiola and colleagues [16]. This pattern can be explained by the atrophy of the rhabdosphincter and the natural neural degeneration that occurs with aging.

A prospective study of 88 patients submitted consecutively to RARP by the same surgeon, with posterior reconstruction, indicated that men whose continence had returned within six months after surgery were younger and had fewer lower

urinary tract symptoms before surgery (p = 0.01) [17].

Finally, a retrospective cohort study in Australia did not find any difference in continence after RARP in patients older than 70 years in comparison with younger patients, even though the older patients had less neural preservation [18].

V. PRESERVATION, RECONSTRUCTION AND REINFORCEMENT OF ANATOMICAL STRUCTURES

The main structures responsible for the pelvic support system in men are the rectoprostatic fascia (or Denonvilliers' fascia), puboprostatic ligament, endopelvic fascia, levator ani muscle, detrusor apron and pelvic tendinous arch. To obtain earlier return and higher rates of urinary continence, it is important to preserve these structures. For example, Daouacher and Walden [19], in a prospective cohort study, demonstrated a higher total continence rate (0 absorbent pads/day) from the 3rd to 24th postoperative month in patients that had undergone reconstruction of the posterior aspect of the rhabdosphincter and sparing of the puboprostatic collar after laparoscopic radical prostatectomy.

VI. NERVE PRESERVATION

Neural preservation is known to favor continence. A study involving retrospective analysis of records from 99 men submitted to variable degrees of nerve preservation showed that better continence rates 9 to 12 months after laparoscopic or robotic radical prostatectomy were achieved in patients with at least one completely spared neurovascular bundle [20].

VII. PRESERVATION OF THE BLADDER NECK

The study of Freire [21] with 619 consecutive patients submitted to RARP indicated better continence four months after surgery with preservation of the bladder neck compared to those undergoing the standard technique, with rates of 65.6% versus 26.5% ($p < 0.001$), although the rates were similar 12 and 24 months after surgery. They also concluded that preservation of the bladder neck was not related to increased incidence of positive margins in the prostate base.

A systematic review conducted in 2013 found only one prospective randomized double-blind study evidencing higher continence rates 4 and 12 months after surgery with preservation of the bladder neck (84.2% and 94.5% respectively, versus 55.3% and 81.4% respectively) [22].

Another retrospective study was published in January 2014 in which bladder neck preservation was graded from 1 to 4. The findings indicated that the level of preservation was directly proportional to return of continence, making this preservation an independent predictor of continence three months after surgery [23].

A retrospective study among 52 Turkish men indicated total continence at the moment of urethral catheter removal in all the patients, with no difference in the quality of life, measured through a questionnaire, compared to the preoperative period and 30th day after catheter removal [24].

VIII. PRESERVATION OF THE PUBOVESICAL COMPLEX

Astimakopoulos and colleagues [25] (evidence level III) developed a technique to preserve the pubovesical complex instead of just the puboprostatic ligaments, because of anatomic continuity of the latter with the bladder. This continuity was well described as the detrusor apron in the seminal work of Myers [26]. In this procedure, the prostate is separated from the pubovesical complex and vesico-urethral anastomosis is carried out below the complex. This led to an impressive 80% rate of total continence and only 20% need for a safety pad at the moment of catheter removal.

IX. POSTERIOR RHABDOSPHINCTER RECONSTRUCTION

Coelho and colleagues [27] analyzed 803 consecutive patients submitted to RARP, of whom 330 underwent posterior reconstruction of the rhabdosphincter and 473 did not. They obtained respective continence rates of 28.7% and 51.6% one and four months after surgery with posterior reconstruction, versus 22.7% and 42.7% for the standard technique, respectively ($p = 0.048$ and $p = 0.016$).

Gondo and colleagues [28] showed that the only factors predictive of continence 30 days after surgery were posterior rhabdosphincter reconstruction associated with preservation bladder neck preservation (OR 2.248, $p = 0.0402$).

A review covering comparative studies or case series with $n > 100$ showed that posterior rhabdosphincter reconstruction improves recovery of continence 30 days after surgery [2].

A retrospective study [29] of 36 consecutive patients submitted to RARP between November 2012 and June 2013 showed that a more complex posterior reconstruction, where the puborectalis muscle is used bilaterally to create a type of posterior hammock to support the urethra, produced full return of continence 30 days afterward in 83% of the patients. This outcome was significantly better than the reconstruction proposed by Rocco [30].

A single-blind randomized controlled trial with 100 patients, divided into two groups (posterior reconstruction opposing the median dorsal raphe only to the posterior counterpart of the detrusor apron versus a second plane including Denonvilliers' fascia) found significantly shorter social continence recovery time (0-1 pad/day) in the first group ($p = 0.024$) [31].

On the other hand, the phase II randomized clinical study of Sutherland [32] and the study of Menon [33] did not find any advantage of posterior reconstruction regarding earlier return to continence.

Finally, a systematic review conducted by Rocco and colleagues [8] in 2012 showed improved early continence return within the first 30 days after surgery, while continence rates 90 says afterward were not affected.

X. ANTERIOR SUSPENSION POINT

Patrick Walsh [34] was the first to describe the new radical retropubic prostatectomy technique, involving passage of the suture from the prostatic venous plexus through the pubis making a figure-eight. After this, various other articles were published.

A prospective study of 229 patients submitted to RARP and divided into two groups, one (n=87) of patients who received an anterior urethropexy stitch and the other (n=142) without AU, with application of the EPIC questionnaire, found a difference in favor of the procedure (p = 0.015) [35].

The prospective study by Patel and colleagues [36] of 331 consecutive patients without preservation of the detrusor apron found better continence rates three months after catheter removal among patients with application of a periurethral retropubic suspension stitch versus patients without placement of the suspension stitch (p = 0.013). Other authors have also found significantly better early continence return with the combination of posterior reconstruction and anterior suspension stitch [37] – [39].

XI. SUTURE OF THE BLADDER IN THE TENDINOUS ARCH WITH TOTAL RECONSTRUCTION

Tewari and colleagues [40] found continence rates with anterior and posterior reconstruction associated with suture of the bladder in the tendinous arch of 38%, 83%, 91% and 97% after 1, 6, 12 and 24 weeks, respectively, with statistically significant differences compared to the standard technique or only with anterior reconstruction. This result was analogous to correction of the paravaginal defect that causes anterior bladder prolapse (cystocele) in women.

XII. PLICATURE OF THE BLADDER NECK

A cohort study indicated that with application of a bladder neck plication stitch, the time for return of social continence (0-1 pad/day) was 3.63±3.01 vs. 5.33±4.89 weeks when this stitch was not applied (p = 0.004). This improved outcome also occurred regarding total continence, which occurred after 5.10±3.80 weeks in the group submitted to plicature vs. 8.49±6.32 weeks in the control group (p = 0.002) [41].

XIII. MAXIMAL URETHRAL LENGTH PRESERVATION (MULP)

A prospective study comparing three groups of 30 patients submitted to maximal urethral length preservation x MULP associated with posterior and anterior reconstruction x isolated reconstruction showed that MULP associated or not with reconstruction obtained the best continence rates 30, 60 and 180 days after RARP [42].

XIV. BLADDER NECK SUSPENSION

Stolzenburg and colleagues [43] evaluated the effect of bladder neck suspension in 180 patients divided randomly regarding performance of bladder neck suspension with and without nerve sparing in robotic prostatectomy. Continence was evaluated by determining the pad weight on the second day after catheter removal and by a questionnaire applied three months after surgery. There was no significant difference between the groups regarding these measures.

However, in a study conducted in 2014, among 57 patients divided into two groups, with and without bladder neck suspension in RARP, Kojima and colleagues [44] found a significant gain in continence 30 days after surgery in the patients submitted to suspension.

XV. USE OF DRUGS TO IMPROVE CONTINENCE

The Vanguard Trial, a randomized, double-blind study, investigated the effect of solifenacin succinate vs. a placebo on the postoperative return to continence after RARP. There was no significant difference in the time to obtain continence, but a larger proportion of patients were continent at the end of the study in the medicated group (77%) [45].

XVI. USE OF DEHYDRATED HUMAN AMNION/CHORION MEMBRANE ALLOGRAFT NERVE WRAP AROUND THE PROSTATIC NEUROVASCULAR BUNDLE

A recent case-control study found a continence rate of 81% eight weeks after surgery involving placement of dehydrated human amnion/chorion membrane around the neurovascular bundle during nerve-sparing RARP, in comparison with 74.1% in the control group (p=0.373), with a significant difference in time to continence (1.21 months vs. 1.83 months, p = 0.033) [46].

XVII. FINAL CONSIDERATIONS

From the information contained in the literature to date, prostate size does not appear to influence continence, while BMI has a negative effect on this outcome.

Retrospective studies indicate that urinary control rates are better in younger patients, although there is conflicting data in the literature. This can be explained by the degeneration of the rhabdosphincter which occurs with age.

These predictive factors appear to lose importance among more experienced surgeons, based on thousands of cases.With regard to preservation of the bladder neck and pubovesical complex, the results are in general agreement that continence returns earlier with their preservation, including a study with evidence level I regarding preservation of the internal sphincter.

Posterior reconstruction also promotes early continence return, with the more complex reconstructions being more favorable.

Studies with a reasonable evidence level demonstrate the benefit of the use of an anterior suspension stitch to obtain early continence return after RARP.

With respect to suture of the bladder in the tendinous arch, this promotes early continence return, with analogy to the correction of cystocele in woman with paravaginal defect.

The literature also indicates that maximal urethral length preservation is important during dissection of the prostatic apex and performance of ligature and section of the Santorini, or venous, plexus.

Plicature of the bladder neck also improves urinary control in robotic prostate surgery in comparison to procedures without use of a plication stitch.

Another technique that can improve continence rates 30 days after RARP is bladder neck suspension, although the findings in the literature are not uniform in this respect, so further research is necessary for better definition.

A recent study (evidence level I) of the use of solifenacin succinate vs. a placebo on the postoperative return to continence after RARP showed a higher continence rate at the end of the study in medicated patients, but continence did not

return earlier with administration of the drug.

A new technique is the placement of dehydrated human amnion/chorion membrane around the neurovascular bundle during nerve-sparing RARP. An evidence level III study showed a significant reduction in the time to obtain continence with application of the technique.

XVIII. CONCLUSION

According to the data in the literature, all efforts at pelvic anatomical preservation or reconstruction contribute to earlier continence return. Nevertheless, studies with better evidence level (some under way) are needed to provide further support for these findings.

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ABBREVIATIONS

EPIC: Expanded prostate cancer index composite
BMI: Body mass index
RARP: Robot-assisted radical prostatectomy
LRP: Laparoscopic radical prostatectomy
RP: Open radical prostatectomy

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