Is this the ultimate solution to fight erectile dysfunction post radical prostatectomy?

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We read with interest the article by Song and colleagues (1) recently published on European Urology regarding the evaluation of a brand-new intraoperative method to monitor and map the cavernous nerve during robot assisted radical prostatectomy (RARP).

This is a prospective phase I/II feasibility study. The authors have evaluated a number of 30 patients with prostate cancer who underwent RARP in their academic hospital. Pudendal somatosensory evoked potential, bulbocavernosus reflex, spontaneous corpus cavernosum electromyography (CC-EMG), median nerve stimulation evoked CC-EMG, and neurovascular bundle-triggered (NVB-triggered) CC-EMG with various stimulation protocols were assessed during RARP performed under total intravenous anesthesia with controlled muscle relaxation (TOF 2).

The protocol aims to quantify the rate of NVBs preservation, the agreement between measurement of NVBs preservation and subjective grade scored by the surgeon (2), and correlation with structural preservation and postoperative functional aspects, such as potency recovery up to 12 months (1). Song and colleagues were able to define the procedures to achieve a safe intraoperative cavernous nerve monitoring and to map the NVBs using CC-EMG during RARP. They demonstrated a good correlation between the protocol and postoperative erectile function (1).

Surely this article highlights one of the main urological issues, that is functional recovery after radical prostatectomy. NVBs preservation during RARP aims to achieve compete oncological resection, while maintaining the integrity of periprostatic nerves to optimize functional outcomes.

Indeed, continence and potency recovery are still major concerns for surgeons but mostly for the patient, who are keen to maintain excellent results, not only in oncological terms.

During the years, several techniques and new approaches have been proposed to improve continence rate; among these we have to mention the running Van-Velthoven anastomosis and the posterior reconstruction or "Rocco stitch" (3), the ligation of the Santorini plexus or dorsal vein to maximize the urethral length, Retzius-sparing approach for RARP (4-6).

In the past years, erectile function has been not so widely investigated. According to anatomical studies carried by Walsh in the Eighties, NVBs lay in the Retzius-space and are the structures more involved in the preservation of erectile function (7).

Only recently, this theory has been doubted; new works on microanatomical structures have documented a complicated neural organization of the NVBs; NVBs seems to be distributed all around the prostate, completely enveloping it, also including the anterior surface and seminal vesicles (8,9) in a "hammock-like" arrangement (10).

Anatomy and physiology are complex; many mechanisms and structures still need to be completely discovered and known. Kaiho and coworkers were pioneers in electrophysiological investigation on NVBs; their studies

have demonstrated the essential role of these nerve fibers to support physiological erections (11).

Studies concerning NVBs and erectile function recovery, like the one by Song and colleagues (1) are therefore required and welcomed.

They also tried to answer to the need to intraoperatively identify and quantify the rate of NVBs preservation.

Shin *et al.* (12), Chandak *et al.* (13), Porpiglia *et al.* (14) have been working on this aspect for some years using 3D reconstruction technology and augmented reality.

In the urological word, the 3D model technology has been introduced to preoperatively identify the proper and the easiest surgical plans, at the beginning only for kidney cancer and only later also for prostate cancer (15).

Concerning prostate cancer models, the very first studies in literature were trying to prove the importance of this innovative method to perform "cognitive" surgeries (15).

Shin and colleagues (12) demonstrated that 3D models help the surgeon to modify and change the surgical plan thanks to the precise location of prostate cancer, cancer's relationship with NVBs and the prostate capsule, achievable thanks to multiparametric magnetic resonance imaging (mpMRI).

Chandak and coworkers (13) highlighted the importance of the tactile interaction with a printed model during RARP. The 3D printing technology allowed the surgeon to decide if better remove the NVBs around the palpable tumors or if better perform a nerve sparing (NS) procedure (13).

Similarly, Porpiglia and his team (14) showed that surgeons evaluated 3D models as incredibly helpful instruments during several steps of surgery.

The same authors led by Porpiglia have presented their original experience using Hyper Accuracy 3D (HA3D) reconstructions (16). Virtual models reproducing the prostate, the tumour, the NVBs, and the urethra based on high-resolution mpMRI images were inserted into the robotic console by Tile-Pro (16).

This study has given a big impulse in the research and in the implementation of the works aimed at improve the overlapping of virtual images during RARP.

Interesting studies regarding neuro-protection and neuro-regeneration for the improvement of potency after RARP have been recently published (17). They mostly evaluate the application of membranes treated with chitosan (ChiMe) after a NS-RARP, documenting an improvement in potency recovery in the group of patients treated with ChiMe in the first two months after surgery. These benefits were not statistically significant in the following months (17).

All these original works require a lot of specialized teams, are expensive, aren't easily reproducible; on the contrary, they are surely interesting and open a direct window on what happens during surgery.

These technologies seem to be really promising and able to help surgeons to identify the different structures and tissue involved by neoplasm; moreover, great applications can be expected in setting a pre operatory strategy, for training or to better inform and advise patients (18).

The paper by Song also aims to evaluate the correlation between quantification and subjective nerve preservation grade scored by the surgeon (1).

Similarly, a novel approach called scoring adherence to prostatic surgical aims (ScAPSA) has been published; the ScAPSA aims to assess surgical proficiency, considering surgical success as perfect adherence to a correct surgical plan, and not related solely to clinical outcomes. ScAPSA involves complete deconstruction and analysis of the surgical plan and evaluation of specific skills and tasks involved in performing RARP (19).

It is necessary to highlight some critical issues and limitations that emerge from Song's study. They have performed cavernous nerve localization test, but not during the protocol-setting period due to time restriction; they could not filter signal at <1 Hz because of device limitation; they might have lost information and have lower CC-EMG amplitude; comorbidity (i.e., diabetes or hypertension) could have impaired pre- and post-operative erectile function; moreover, pelvic lymphadenectomy could have influenced postoperative potency recovery (1).

Despite these limitations, the paper published by Song *et al.* has surely the credit to point out that the improved potency recovery after RARP seems to be related with a more accurate and precise knowledge of NVB anatomy. Technical developments in robotics can also help surgeons to guarantee a greater NVBs preservation and a better quality of life for patients.

Studies are needed to validate and improve the technologies and the knowledge we actually have.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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