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Effects of Transurethral Prostate Resection and Transurethral Laser Prostatectomy on Plasma Hormone Levels

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Abstract

Objective: The short and long-term effects of two common transurethral procedures (TURP and TULP, transurethral prostatic resection and laser prostatectomy, respectively) on plasma hormone levels in patients with benign prostatic hyperplasia (BPH) have been evaluated. **Patients and Methods:** Totally 57 patients with histologically proven BPH (age range 54-81 years, mean 62.5 years) were included into the study program. Of these 57 patients, 44 underwent TURP and 13 underwent TULP for treatment of their bladder outlet obstructions. 20 patients with bladder cancer undergoing transurethral resection (n = 15) and those undergoing transurethral laser ablation (n = 5) constituted the control group. Plasma luteinizing hormone (LH), prolactin (PRL), follicle-stimulating hormone (FSH), adrenocorticotrophic hormone (ACTH), cortisol, aldosterone, dihydroepiandrosterone sulfate (DHEA-S) and testosterone levels were assessed in all patients before and after 3 weeks and 3 months following the aforementioned procedures. Comparative evaluation of the results with respect to the effect of different procedures have been made between study and control groups. **Results:** Preoperatively, we were not able to demonstrate any significant difference with respect to all but plasma prolactin levels (p < 0.05) between the study and control groups. Prolactin levels were found to be significantly higher in BPH patients. In BPH patients undergoing TURP, while LH levels were significantly higher during the 3 weeks' evaluation (p < 0.001) no significant difference could be shown during the 3 months' examination (p > 0.05). Again, prolactin levels did significantly decline (p < 0.05) in patients undergoing TURP during the 3 weeks' follow-up evaluation, no difference was present 3 months postprocedure. On the other hand, in patients undergoing TULP, while we were not able to show any significant difference with respect to plasma prolactin levels (p > 0.05) pre- and postoperatively, plasma LH levels were significantly increased during the 3-month evaluation (p < 0.05). **Conclusions:** Alterations in the plasma levels of LH and prolactin following prostatectomy during follow-up evaluation, led the physicians to consider possible effects of some factors released from resected prostate gland. Behavior of prolactin and LH after TURP and laser ablation is quite different in our study. It may be related to the higher amount of residual prostate tissue after TULP. On the other hand, normalization of hormone levels 3 months following TURP, led us to think about the activation of some factors responsible for hormonal regulation which in turn institutes a new hormonal balance.

Key Words

Benign prostatic hyperplasia
Transurethral procedures
Laser
Plasma hormone levels

Introduction

The prostate gland plays an important role in reproductive physiology and may undergo hyperplasia with aging in male population. The prostate is mainly a glandu-

lar organ and regularly secretes some material during sexually active ages. On the other hand again, the vital role of plasma hormones on prostatic growth, benign hyperplastic alteration and cancer formation has been subjected to numerous clinical and experimental studies to date. Espe-

cially the effects of androgens on this aspect have been well evaluated. In addition to the hormonal milieu, the possible effects of the neural system on prostatic enlargement has also been evaluated in detail, and this innervation was reported to be altered in such patients [1].

Apart from the effects of systemic hormones on prostate metabolism, some factors found in the prostate gland itself have also been proven to be effective in hormonal regulation. Among these, adrenocorticotrophic hormone (ACTH) [2], thyroid-releasing hormone (TRH) [3], inhibin, and inhibin-like substance [4] can be mentioned. However, the exact role of these prostatic peptides on hormonal regulation have not been clearly outlined up to now. Related with this subject, animal studies demonstrated some changes in hypophyseal and adrenal gland functions following prostatectomy [5]. Alterations in some hypophyseal hormones such as luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone and prolactin have been shown after prostatectomy procedure [6, 7].

Taking all these hormonal interactions into account, the possible effects of transurethral prostatic resection (TURP) and transurethral laser prostatectomy (TULP) on plasma hormone levels during short- and long-term evaluations (3 weeks and 3 months, respectively) were assessed in our prospective study in patients with benign prostatic hyperplasia (BPH).

Patients and Methods

Totally, 57 patients with histologically proven BPH were included in the study program. The age of the patients ranged from 54 to 81 years with a mean value of 62.5 years. Of these 57 patients 44 underwent TURP and 13 TULP for the surgical relief of prostatic obstruction.

Following a detailed history, complete urological examination (including rectal palpation of the prostate) was performed. All patients underwent preoperative detailed evaluation and documentation of medical and urological status. This included a detailed history, complete physical examination (including rectal palpation of the prostate), uroflowmetry, serum electrolytes, creatinine, complete blood counts (CBC), prostate-specific antigen, urinalysis and urine culture. Apart from the excretory urogram, transrectal sonography findings were noted in every case. None of them had endocrine disorders or other severe diseases. The volumes of the prostates operated were almost in the same range (52–58 g, mean 54 g) in order to eliminate the effect of resected tissue volume on study parameters. Following all these evaluation procedures, serum hormone levels were detected in all patients. LH, FSH, ACTH, prolactin and aldosterone were determined by solid-tube radioimmunoassay (RIA). Plasma cortisol and testosterone levels were measured by double-antibody RIA and DHEA-S by chemiluminescence (immulite) methods. Nor-

mal range values for these hormones were as follows: LH 0.4–5.7 mIU/ml; prolactin 3–17 ng/ml; FSH 1.1–13.5 mIU/ml; testosterone 280–880 ng/dl; cortisol 7–25 µg/dl; ACTH 10–100 pg/ml; aldosterone 40–310 pg/ml; DHEA-S 80–560 ng/ml. Hormonal assessment was performed preoperatively 3 weeks and 3 months after the aforementioned procedures.

Patients were not under any special diet and were not receiving any medication which could affect the serum hormone levels.

Control group patients included 15 patients who underwent TURP and 5 patients who underwent TULP for superficial bladder cancer. The age of the patients ranged from 58 to 79 years with a mean value of 63.7 years. All these patients again had no active disease nor were on effective medication for other reasons during the study program.

Transurethral resection of the prostate and bladder cancer was performed by using a 24 F resectoscope under endocamera vision (STORZ Telecam pal 202100 20). On the other hand, ablation of the prostate and bladder cancer was performed by using a 600-µm internal reflector fiber covered by a quartz glass cup that reflects the Nd-YAG beam at 80° to the fiber axis (Ultraline, Heraeus Laser Sonic, Milpitas, Calif., USA; power density produced by laser unit was 60–80 W). Mean total energy was 27,000 ± 4,500 joule. One session of TULP procedure was adequate in all patients to relieve prostatic obstruction.

Student's t test and paired t test were used for statistical significance analysis.

Results

Comparative evaluation of our findings between patients in the study and control groups revealed the following results:

Preoperative Evaluation

Preoperatively and postoperatively, no statistically significant ($p > 0.05$) alteration could be demonstrated in FSH, ACTH, testosterone, cortisol and aldosterone (table 1). Preoperatively, prolactin levels were found to be significantly elevated in BPH patients (control group mean ± SD 8.3 ± 2.4; BPH group mean ± SD: 11.7 ± 3.9) ($p < 0.05$). Plasma hormone levels were not significantly different according to the different age groups both in BPH and control group.

Postoperative Evaluation

TURP Group. Following TURP in patients with BPH, LH concentrations were found to be significantly elevated in comparison to preoperative values during the 3 weeks' evaluation ($p < 0.001$). LH concentrations were significantly higher in BPH patients than in the controls. However, no significant alteration with respect to LH levels could be shown during the 3-month follow-up examination. Comparative evaluation with preoperative values

Table 1. Pre- and postoperative evaluation of plasma hormone levels (FSH, ACTH, testosterone, DHEA-S, cortisol, aldosterone, prolactin and LH)

Hormones	Preoperative		Postoperative			
	control (n = 20)	BPH (no = 57)	3 weeks		3 months	
			control	BPH	control	BPH
FSH, mIU/ml	6.9±4.2	8.4±3.2	7.5±4.5	8.9±3.5	7.4±4.3	8.7±3.4
ACTH, pg/ml	19.2±4.5	17.6±5.2	17.9±4.3	18.7±4.6	18.5±4.4	18.4±4.5
Testosterone, ng/dl	568.4±168	518.3±143	571.3±172	526.5±152	531.5±156	519.4±149
DHEA-S, ng/ml	148.3±69	124.6±43	143.2±66	129.4±48	137.2±61	134.5±59
Cortisol, µg/dl	12.2±5.7	13.7±4.3	13.1±6.1	13.4±4.1	12.9±5.9	13.5±4.5
Aldosterone, pg/ml	32.6±4.7	35.3±6.4	32.4±4.6	36.2±6.2	34.7±5.7	35.8±6.1
Prolactin, ng/ml	8.3±2.8	11.7±3.7	8.9±2.3	8.9±4.1	8.4±2.3	10.2±4.4
LH, mIU/ml	4.6±3.2	4.5±1.9	4.2±1.2	8.6±2.5	4.4±1.3	5.4±1.4

Mean values ± SD.

and the results of control patients revealed no difference ($p > 0.05$) (fig. 1).

Again, evaluation of prolactin levels showed that although a significant decrease was observed 3 weeks post-procedure (TURP) ($p < 0.05$), normalization of plasma hormone levels was observed during the 3 months' follow-up ($p > 0.05$) (fig. 2).

TULP. Evaluation of plasma LH levels after TULP did not show any alteration during the 3 weeks' follow-up. However, a significant elevation in plasma LH levels was observed 3 months postprocedure ($p < 0.05$) (fig. 3).

No significant alteration could be demonstrated with respect to prolactin levels both in the early (3 weeks) and the late (3 months) follow-up examinations ($p > 0.05$) (fig. 4).

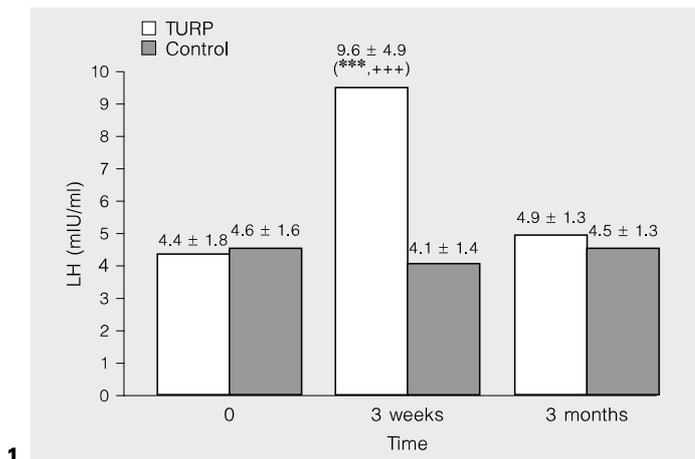
The volume of the remaining BPH tissue was evaluated by transurethral ultrasound (TRUS) 3 months after the procedures. It was found to be significantly different in the TURP and TULP groups, respectively, at 11.2 ± 2.1 and 29.3 ± 3.4 ($p < 0.001$).

Comparison between patients undergoing TURP and TULP with respect to plasma LH levels showed that while the LH levels were significantly higher in the patients in the TURP group ($p < 0.001$) during the 3 weeks' follow-up, significantly higher levels were observed in patients undergoing TULP during the 3 months' follow-up ($p < 0.01$) (fig. 5). On the other hand, again, while there was a significant decline in plasma prolactin levels in patients undergoing TULP during the 3 weeks' follow-up ($p < 0.05$), no significant difference could be demonstrated between the two groups during the 3 months' follow-up evaluation ($p > 0.05$) (fig. 6).

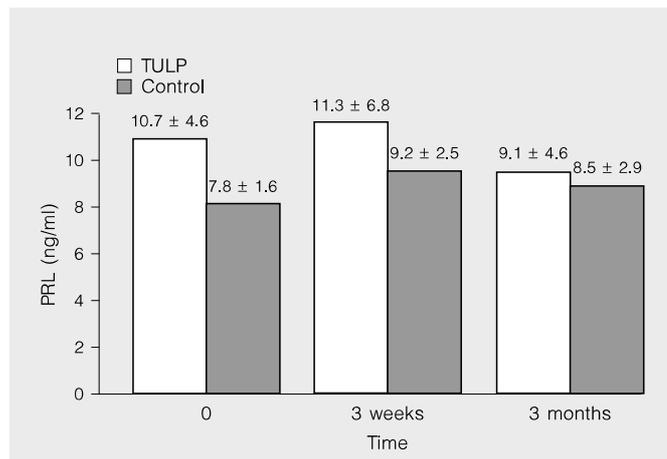
Discussion

The prostate is mainly a gland and its secretion is under the influence of several hormones. Although testosterone is accepted to be the most important hormone in prostatic regulation, plasma estrogen levels have been reported to be more effective on prostatic secretion. Apart from hormonal factors, the human prostate has been found to be supplied by nerves [1]. On the other hand, some factors in the prostate gland have recently been defined and found to be possibly effective on plasma hormones which in turn regulate prostatic secretion [2–4]. Testosterone, the main androgenic hormone affecting prostatic growth and function, inhibits gonadotropin secretion at both the pituitary and the hypothalamic levels in men [8]. In addition, studies have demonstrated that in patients with prostatic hyperplasia LH secretion has been thought to be under a negative feedback control produced by testosterone metabolites originating from the hypertrophic prostate [6, 9]. Thus, a prostate-hypophysis axis has been proposed in the regulation of LH secretion on the basis of low LH concentrations observed in BPH patients.

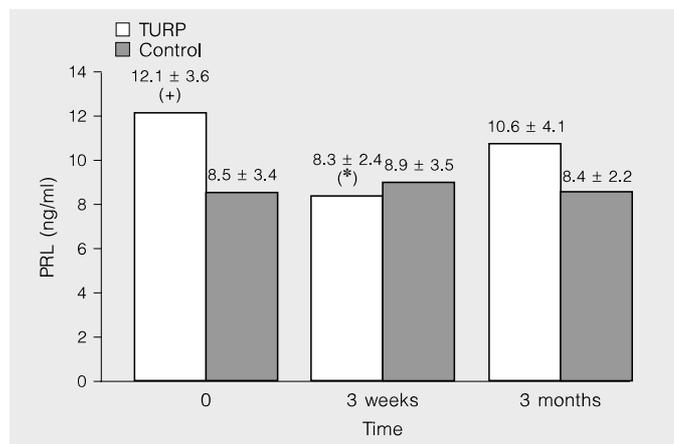
Regarding the plasma levels of other hormones, while testosterone levels show a significant decrease in BPH patients, no significant alteration could be shown with respect to FSH, LH, prolactin and estradiol levels [10]. While it has been reported that serum LH, FSH and progesterone levels have been found to be more elevated in patients with BPH than the control cases [11], in their original study Sasagawa et al. [7] have been able to show that plasma prolactin levels are elevated more significant-



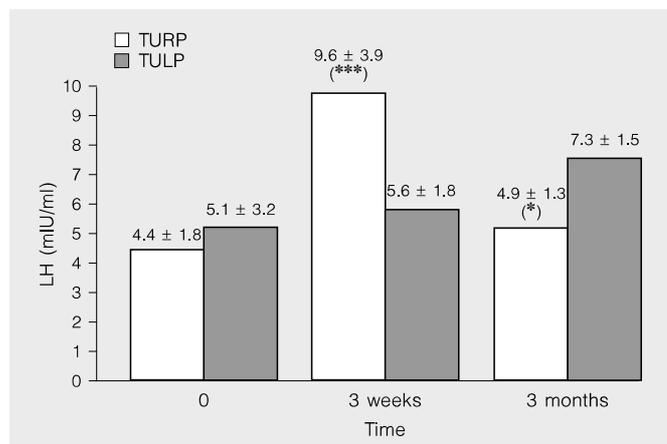
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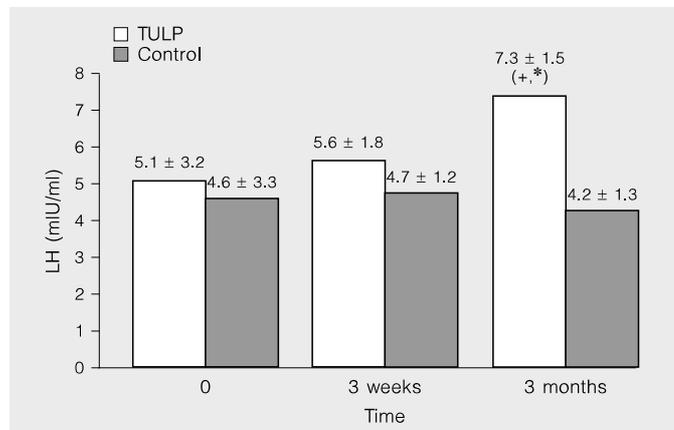
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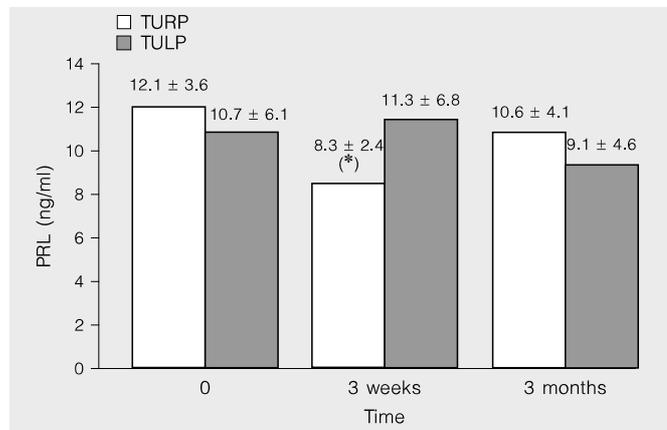
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Fig. 1. Postoperative evaluation of LH levels between patients undergoing TURP and controls (***p* < 0.001 compared with before surgery; +++ *p* < 0.001 compared with control group).

Fig. 2. Evaluation of serum prolactin levels postoperatively in patients undergoing TURP (+ *p* < 0.05 compared with control group; * *p* < 0.05 compared with before surgery).

Fig. 3. Evaluation of LH levels postoperatively in patients undergoing TULP (+ *p* < 0.05 compared with control group; * *p* < 0.05 compared with before surgery).

Fig. 4. Evaluation of serum prolactin levels in patients undergoing TULP postoperatively.

Fig. 5. Demonstration of serum LH levels in both groups during short- and long-term follow-up evaluation (***p* < 0.001, * *p* < 0.05: TURP compared with TULP).

Fig. 6. Evaluation of plasma prolactin levels in both groups during short- and long-term follow-up examination (* *p* < 0.05: TURP compared with TULP).

ly than in control patients. Related to this subject, the prostate has been thought to secrete a prolactin-regulating factor which possibly affects the plasma levels of prolactin in such patients [12].

In our study, preoperatively all serum hormones but prolactin did not show any significant alterations in BPH patients in comparison to the controls.

Regarding LH levels in patients undergoing TURP, a significant elevation 3 weeks postprocedure in comparison to preoperative values has been reported. This alteration was again significant with respect to the values observed in control patients [7]. In our study, a significant alteration in plasma LH levels has been observed in patients undergoing TURP during the 3 weeks' follow-up. However, after 3 months' follow-up, plasma LH levels returned to the normal range. Decrease in LH levels after TURP at the 3 weeks' follow-up examination was found by rectal sonographic evaluation not to be related to residual adenoma or regrowth of the gland. On the other hand, LH levels did not show any alteration during the 3 weeks' evaluation in patients undergoing TULP. However, during the 3 months' evaluation, a significant increase in plasma LH levels in these patients was noted.

Related with plasma prolactin levels, an experimental study on male rats showed that at 14 and 21 days following prostatectomy, plasma levels had increased significantly. The authors have indicated that the inhibition of dopamine turnover in the medial basal hypothalamus and the median eminence after prostatectomy could induce such results [13]. Rolandi et al. [14], however, have been able to show that prolactin levels could decrease following prostatectomy. Similar results have been observed after TURP on days 14 and 21 [7].

In our patients, while a significant decrease in prolactin levels in patients undergoing TURP was noted during the 3 weeks' follow-up, hormonal levels returned to the normal range after 3 months. No alteration in plasma prolactin levels could be observed in patients undergoing TULP after 3 weeks or after 3 months.

Due to the inhibitory effect of dopamine on prolactin secretion, prolactin hypersecretion in BPH patients could be related to inhibition of the hypothalamic dopaminergic system [12, 15]. On the other hand, in addition to its stimulating effect on TSH, TRH stimulates prolactin secretion [16].

Observation of high concentrations of homologous TRH peptides in human and rat prostates has supported this proposal [3]. Thus, a decrease in post-operative prolactin levels may originate from the cessation of TRH stimulation from the prostate gland. However, apart from

TRH, the prostatic gland secretes some other factors and the exact mechanism of TRH suppression has not been outlined clearly. Observation of the normalization in prolactin levels after 3 months has led physicians to think that some other factors effective on prolactin levels are present.

Experimental studies demonstrate the stimulation of adrenal corticosteroidogenesis and adrenal hyperplasia following removal of the ventral prostate [5]. However, no alteration has been reported in adrenal function following TURP [7]. In our study as well, no abnormal change could be demonstrated in adrenal hormones (cortisol, aldosterone and DHEA-S) after transurethral resection of the prostate. Again, plasma FSH, ACTH and testosterone levels did not exhibit any significant alteration postoperatively.

Behavior of prolactin and LH after TURP and laser ablation is quite different in our study. It may be related to the higher amount of residual prostate tissue after TULP.

In summary, in the light of our findings and the literature data, alterations in plasma LH and prolactin levels following transurethral procedures led us to think of a possible effect of the prostate gland on these hormones. However, the normalization of these changes in late follow-up (3 months) indicated the presence of some other factors which are effective on plasma hormone levels. The activation of these factors may contribute to the normalization phase of abnormal alterations in hormonal interactions. We believe that further clinical and experimental studies including larger series of patients and certain other parameters are needed in order to give more reliable data.

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