African Journal of Urology

ORIGINAL RESEARCH Open Access

The effect of short-term use of finasteride versus cyproterone acetate on perioperative blood loss with monopolar transurethral resection of prostate

Shabieb A. Abdelbaki[1*], Adel Al-Falah[1], Mohamed Alhefnawy[1], Ahmed Abozeid[2] and Abdallah Fathi[1]

Abstract

Background: Perioperative bleeding is the most common complication related to transurethral resection of prostate; the aim of the study was to compare the effect of pre-operative use of finasteride versus cyproterone acetate (CPA) on blood loss with monopolar TURP.

Methods: This prospective randomized controlled study was conducted on (60) patients with BPH underwent monopolar TURP between July 2019 and July 2020. Patients were distributed into three equal groups; CPA group: 20 patients received cyproterone acetate 50 mg tab BID for two weeks before TURP, finasteride group: 20 patients received single daily dose of finasteride 5 mg for two weeks before TURP, control group: 20 patients received no treatment before TURP, all patients underwent monopolar TURP, and then histopathological examination of the resected tissues was done with assessment of the microvascular density of the prostate.

Results: Our study showed that there was significant decrease in intraoperative blood loss and operative time in CPA and finasteride groups in comparison with control group ($p = 0.0012$) ($p < 0.0001$), respectively, significant decrease in post-operative Hb and HCT value in finasteride and control groups in comparison with CPA group ($p < 0.01$), significant increase in specimen weight in CPA group compared to other groups ($p < 0.01$), and there was also significant decrease in microvascular density in CPA group in comparison with other groups ($p < 0.01$).

Conclusion: Cyproterone acetate is more effective than finasteride in decreasing perioperative bleeding with TURP by decreasing microvascular density of the prostate.

Keywords: Benign prostatic hyperplasia, Cyproterone acetate, Transurethral resection of prostate

1 Background

The gold standard surgical management of benign prostatic hypertrophy (BPH) is transurethral resection of prostate (TURP), although it is accompanied by some morbidity. Absorption of irrigation fluid and perioperative blood loss are the most common complications related to TURP especially with markedly enlarged prostate, and many previous studies showed that perioperative blood loss with TURP can be reduced by preoperative administration of finasteride that act by decreasing dihydrotestosterone level [1–4].

Puchner and Miller postulated that 5ARIs act by inhibiting the conversion of testosterone to dihydrotestosterone which leads to reduced level of androgen-derived growth factors (fibroblastic growth factor, epidermal growth factor and vascular endothelial growth factor) required for angiogenesis. This leads to decreased blood

*Correspondence: drshabieb@yahoo.com; drshabeb2021@gmail.com
[1] Department of Urology, Faculty of Medicine, Benha University, Qalubeya, Egypt
Full list of author information is available at the end of the article

flow and vascular density of prostate and reduces the rate of haematuria associated with BPH [5].

CPA is a steroid antiandrogen closely related in structure to progestogens. CPA inhibits the negative diencephalic pituitary testicular feedback system, thus lowering luteinizing hormone and testosterone production and plasma levels. At the molecular level, CPA interferes with androgen binding to the androgen receptor; in prostatic tissue this suppresses prostatic growth [6].

CPA has been widely used in the past for endocrine treatment of prostate cancer; evidence from studies of patients with BPH shows that CPA causes atrophy, an effect comparable to that caused by castration [7]. In addition, it has been also used for some non-oncological diseases that necessitate reduction of serum testosterone or its action, such as severe female hirsutism, hormone therapy for male-to-female transsexuals and precocious puberty [8].

Elgammal et al. showed that CPA decreased the perioperative blood loss with TURP by decreasing the MVD of prostate [8].

Our study was the first study to compare the effectiveness of the two drugs in decreasing perioperative blood loss with TURP.

2 Methods

This prospective randomized controlled study was conducted on (60) patients with BPH who underwent monopolar TURP between July 2019 and July 2020 at our urology department.

Patients with BPH with prostate size (60–100) grams and presented with any of the following: Lower urinary tract symptoms (LUTS) with no response to medical treatment, recurrent prostatic bleeding, recurrent acute urinary retention or chronic urinary retention were included in this study. Patients with coagulation disorders, previous prostatic surgery, previous finasteride administration, neurogenic bladder, UB stones, and bladder mass, suspected or proved cancer prostate, haematuria within 2 weeks before the study start date, hepatic or renal impairment or patients unfit for operation, e.g. decompensated heart failure and poor chest condition, were excluded from the study.

All patients were preoperatively assessed by detailed medical and surgical history, complete physical examination including digital rectal examination, labs (CBC, liver and kidney function, coagulation profile, prostatic specific antigen (PSA); pelvi-abdominal ultrasonography was done by the same radiologist to assess prostate volume, post-voiding residual urine and any bladder pathology. patients were distributed randomly into three equal groups. CPA group: 20 patients received CPA 50 mg tab BID for 2 weeks before TURP, finasteride group B: 20 patients received single daily dose of finasteride 5 mg for two weeks before TURP, control group: 20 patients received no treatment before TURP.

Withdrawal of shuffled cards was used as randomization method. MedCalc software version 16.1 (© 1993–2016 MedCalc Software, www.medcalc.org) was used to calculate the required sample size. Prior data indicate that operative blood loss was lower in group A (35 treated patients), at a mean (SD) of 3.74 (1.52) mL/g vs 8.59 (2.42) mL/g in group B (33 control patients) ($P < 0.001$) [9]. Then, we will need to study 5 experimental subjects and 5 control subjects to be able to reject the null hypothesis that operative blood loss for experimental and control subjects is equal with probability (power) 80%. The Type I error probability associated with this test of this null hypothesis is 0.05. The least sample size was 5 subjects in each group. It was increased to 20 in each group for more accuracy. Data entry, processing and statistical analysis were carried out using MedCalc ver. 18.2.1 (MedCalc, Ostend, Belgium). Tests of significance (Kruskal–Wallis and Chi-square tests) were used. Data were presented also; suitable analysis was done according to the type of data (parametric and nonparametric) which obtained for each variable. P values less than 0.05 (5%) were considered to be statistically significant, and then significant Kruskal–Wallis test was followed by post hoc multiple comparisons using Bonferroni test to detect the significant pairs.

2.1 Operative technique

All patients were given spinal anaesthesia in setting position and then were turned into lithotomy position; sterilization was done. Using a 26 Fr continuous irrigation resectoscope and monopolar diathermy, 1.5% glycine solution as an irrigant fluid, at 60 cm height above the patient standard cystourethroscopy was performed to evaluate the ureteral orifices, the bladder neck, the verumontanum, the prostate and the external urethral sphincter to exclude any other pathology. Then standard nesbit monopolar TURP was done, in case of enlarged middle lobe we started by resecting it from 5 0′ clock to 7 0′ clocks which made a channel for fluid and adenoma chips to flow through. Haemostasis was done at each area before proceeding to the next resection area. Jetty arterial bleeding was often encountered near the capsule and at the bladder neck, as the prostate blood supply arises peripherally. Arteries were cauterized immediately as the blood loss obscures the view and prevents precise resection. Significant venous bleeding was controlled. Bleeding at the bladder neck (particularly anteriorly) was facilitated by reducing bladder volumes allowing these parts of the prostate to be better visualized. Haemostasis confirmed at the end

of the procedure with the resectoscope was located at the apex, the bladder minimally distended, and inflow off. Once resection was completed, all adenoma chips were removed from the bladder using Ellik evacuator. A 22 F 3-way Foleys catheter was inserted and inflated with normal saline. At the end of procedure, continuous bladder wash with normal saline was applied for 24 h postoperative and stopped when the wash becomes clear. Catheter was removed at the fifth postoperative day unless there was bleeding, then postoperative antibiotics were given, analgesics were also prescribed when needed, and operative time was recorded from the start of resection till the end of resection, also weight of resected prostate tissue chips was measured by electronic scale, and the amount of intraoperative blood loss was estimated by collecting the irrigation fluid returns in heparinized buckets to which 1000 U of heparin is added to prevent coagulation of the irrigation solution, then 5 m l of irrigation fluid samples was transferred into EDTA vial for haemoglobin estimation by HemoCue hemoglobinometer, and then the amount of intraoperative blood loss was estimated for each patient according to the following equation: [9]

$$\text{The intra operative blood loss (in ml)} = \frac{\text{Hb concentrationof the irrigant fluid } \left(\text{gm/dl}\right) \times \text{ volume of total irrigation fluid (ml)}}{\text{Preoperative serum haemoglobin}\left(\text{gm/dl}\right)}$$

For more accurate estimation of intraoperative blood loss, we calculated the adjusted blood loss per gram of resected prostate by dividing the amount of intraoperative blood loss by the weight of resected tissue; also the blood loss per minute of operative time was calculated dividing the amount of intraoperative blood loss by the operative time. Haemoglobin concentration and haematocrit value were measured at the next morning after operation, and the drop of Hb and haematocrit value was calculated. Postoperative PSA was done one month after the operation. Also, attacks of postoperative haematuria within two weeks were recorded.

Manifestations of TURP syndrome (mental confusion, nausea, vomiting, hypertension, bradycardia, and visual disturbances) were monitored throughout the procedure and if present, serum sodium and potassium were measured and the procedure terminated as early as possible, and management of the symptoms according to the severity of the case (supporting respiration and the circulation, correction of hyponatremia by hypertonic saline if serum sodium less than < 120 mEq/l).

These operations were done by one of two consultants (SA, AF) as they have good experience in TURP.

2.1.1 Histopathological examination of the resected prostate was done as follows:

Specimens were fixed in formalin (10%), then embedded in paraffin, then stained with haematoxylin and eosin, and examined microscopically to exclude malignancy; in addition the specimens were subjected to monoclonal immunohistochemical antibody to CD-34 which is an endothelial cell antigen specific for nascent blood vessels; CD-34 was established as an effective immunohistochemical marker for prostatic microvessel density analysis. Each section was examined by single blinded examiners who determined the microvessel density of the prostate by calculating positively stained vessels in 10 successive non-overlapping fields within a 10X10 reticulated imprinted grid at 400X amplification.

3 Results

3.1 A—Regarding pre-operative data

The average age of all patients was (68.2 ± 5.8) years, the average prostate size was (77.8 ± 10.5) cm3, the average PVRU was (218.12 ± 66.9) ml, the average IPSS was (26.28 ± 3.9), the average Q max was (7 ± 1.5) years, the average haemoglobin was (13.8 ± 0.8) g/dL, the average HCT was (44 ± 1.5) %, and the average PSA was (2.97 ± 0.85) ng/dl.

There was non-significant difference as regards all pre-operative data between the three groups (p > 0.05). (Table 1).

3.2 B—Regarding intraoperative data

There was significant decrease in operative time, intraoperative blood loss, irrigation fluid volume, blood loss/gram of resected prostate and blood loss/min of operative time in CPA group and finasteride group compared to the control group ($p < 0.01$).

There was significant increase in specimen weight and significant decrease in irrigation fluid Hb in CPA group compared to other groups ($p < 0.01$) ($p < 0.01$), respectively.

There was non-significant difference between the 3 groups as regards incidence of TURP syndrome ($p > 0.05$). (Table 2).

3.3 C—Regarding post-operative data

There was significant decrease in post-operative haemoglobin and HCT in control and finasteride group, compared to CPA group (p < 0.01, respectively).

Table 1 Comparison between the 3 groups as regards pre-operative data using Kruskal–Wallis test

Variable	CPA group (20) Median (IQR)	Finasteride group (20) Median (IQR)	Control group (20) Median (IQR)	Kruskal–Wallis Test P value
Age (years)	68.5 (65 – 71.5)	69.5 (66 – 71.5)	66 (63 – 70.5)	= 0.4647
Prostate size (cm^3)	78.5 (71 – 89)	73.5 (69 – 84)	76.5 (69 – 85)	= 0.4937
PVRU (ml)	225 (146 – 292.5)	200 (165 – 253)	211 (195 – 285)	= 0.6869
IPSS	28.5 (24 – 30)	27.5 (25 – 28.5)	26.5 (22.5 – 28)	= 0.2545
Q max	7 (5.7 – 8)	7 (6.2 – 8)	7 (6.7 – 8)	= 0.6526
Hb (g/dL)	14 (13.1 – 14)	13.8 (13 – 14.2)	14 (13.8 – 14.5)	= 0.3281
HCT (%)	44.5 (44 – 45)	44.4 (43 – 45)	44.8 (44 – 45)	= 0.6044
PSA (ng/dL)	2.8 (2.1 – 3.6)	3 (2.5 – 3.8)	3.1 (2.2 – 3.8)	= 0.6768

Table 2 Comparison between the 3 groups as regards intraoperative data using Kruskal–Wallis test and Significant KW test was followed by post hoc multiple comparisons using Bonferroni test to detect the significant pairs

Variable	CPA group (20) Median (IQR)	Finasteride group (20) Median (IQR)	Control group (20) Median (IQR)	Kruskal–Wallis test *P* value
Operative time (min)	49.7 (47.1 – 57.9)†	48.2 (44.9 –54.4)†	57 (52.9 – 61.7)	< 0.0001**
Specimen weight (gm)	51 (46.1 – 57.8)†‡	44.2 (40.9 – 50.4)	42 (37.9 – 46.7)	= 0.00045**
Intraoperative blood loss (ml)	319 (260 – 375)†‡	378 (349 – 457)†	463 (331 – 479)	= 0.0012**
Irrigation fluid Hb (gm/dl)	0.2 (0.2 – 0.3)†‡	0.3 (0.25 – 0.4)	0.29 (0.2 – 0.3)	= 0.04*
Irrigation fluid volume (L)	18 (16 – 20.5)†	20 (17 – 22.5)†	22 (21 – 24)	= 0.0006**
Blood loss/gram of resected prostate (ml/gm)	5.99 (5.1 – 7)†‡	8.68 (8.1 – 9.5)†	9.9 (8.7 – 10.5)	< 0.0001**
Blood loss/min of operative time (ml/ minute)	5.79 (4.9 – 6.9)†‡	7.95 (7.44 – 8.66)†	7.5 (6.2 – 7.8)	< 0.0001**
TURP syndrome	0/20 (0.0%)	0/20 (0.0%)	1/20 (5%)	= 0.3916

† → sig in comparison with controls

‡ → sig in comparison with Finasteride group

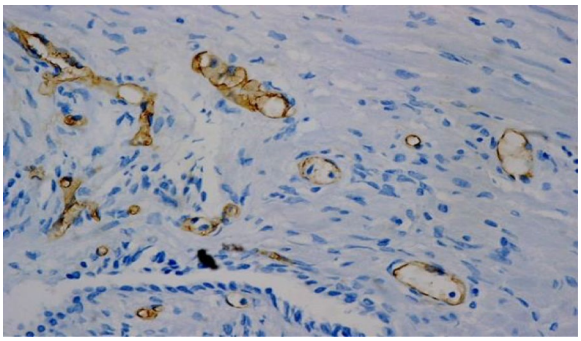

Fig. 1 CD34 staining of prostatic tissue in one patient in control group: showing quantitative increase in microvessel density

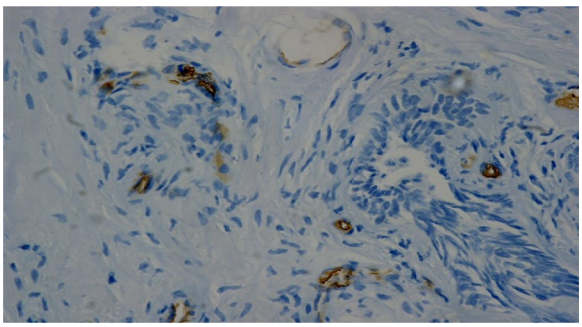

Fig. 2 CD34 staining of prostatic tissue in a patient in finasteride group: showing decrease in microvessel density

There was significant decrease in MVD in CPA group and finasteride group compared to control group ($p < 0.01$, respectively). (Figs. 1, 2, 3).

There was significant decrease in PSA in CPA group, compared to other groups ($p < 0.01$).

There was significant decrease in post-operative haematuria in CPA group, compared to other groups ($p < 0.05$) (Table 3).

Post hoc analysis of intraoperative and postoperative parameters showed that CPA group had significant difference compared to control group in all parameters and showed significant difference compared to finasteride

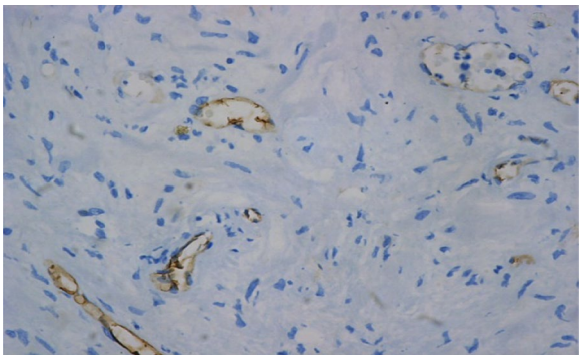

Fig. 3 CD34 staining of prostatic tissue in one patient in CPA group: showing marked decrease in microvessel density

group in all parameter except (operative time, irrigation fluid volume). Also finasteride group showed significant difference compared to control group in all parameters except (specimen weight, irrigation fluid Hb, post-operative PSA).

4 Discussion

BPH presenting with LUTS is a common problem in elderly men. The most reliable and effective treatment option to relieve bladder outlet obstruction due to BPH is TURP [1].

The idea of angiogenesis suppression by androgen deprivation was first used for decreasing bleeding in patients with cancer prostate [10], and then many studies describing the association of finasteride with BPH-related haematuria were published. The first assessment of finasteride use prior to TURP was published in 2000 by Hagerty et al. [11] Experimental (human and animal) data demonstrating the dose-dependent effects of androgens on hypoxia inducible factor 1a, expression of VEGF receptors, and other angiogenic pathways supported these clinical studies [10, 11].

It was found also that patients using antiandrogen have significant decrease in prostate size with increase in the maximum flow rate during spontaneous micturition [12].

Further studies supporting anti-androgens usage to decrease blood loss (during TURP) attributed this effect to the ability to suppress angiogenesis [9]. As a histological and clinical predictor of angiogenesis, prostatic microvascular density is widely used. Studies showed that BPH tissues have much more vessel densities than normal prostate tissues, particularly in areas with nodular morphology. Moreover, patients with BPH and recurrent haematuria have a significantly greater MVD than patients with BPH alone [13].

For patients treated by TURP, it was established that blood loss was markedly decreased in patient treated with finasteride compared with the non-treated patients, regardless the prostate volume [14].

Khwaja et al. reported that finasteride reduces microvessel density and hence prostate vascularity with only 2-week therapy, and the mean MVD was clearly correlated with size of prostate [4].

Furthermore, some controlled trials confirmed the effect of dutasteride in reducing prostatic tissue vascularity decreasing the operative duration and blood loss [15].

Perimines et al. studied the effects finasteride and cyproterone acetate, on haematuria associated with BPH published that cyproterone acetate and finasteride exerted a valuable effect in reducing the incidence of recurrent prostatic haematuria in BPH patients. At one-year follow-up, haematuria had been repeated in 23% of patients treated with cyproterone acetate and 30% of patients with finasteride treatment. While untreated group, 57% of them had recurrent prostatic haematuria,

Table 3 Comparison between the 3 groups as regards post-operative data using Kruskal–Wallis and Chi square tests and significant KW test was followed by post hoc multiple comparisons using Bonferroni test to detect the significant pairs

Variable	CPA group (20) Median (IQR)	Finasteride group (20) Median (IQR)	Control group (20) Median (IQR)	Kruskal–Wallis test *P* value
Hb (g/dL)	12.5 (11.9 – 13)†‡	12 (11.3 – 12.7)†	11.5 (11.1 – 12)	= 0.0073**
HCT (%)	40.7 (39 – 42)†‡	38.2 (36.6 – 39.5)†	37 (36 – 38)	< 0.0001**
PSA (ng/dL)	0.85 (0.64 – 1.09)†‡	1.05 (0.89 – 1.3)	1.24 (0.9 – 1.5)	= 0.0015**
Histopathology (MVD) (vessel/HPF)	8 (7 – 9.5)†‡	14 (12.5 – 15.5)†	20 (18.5 – 21.5)	< 0.0001**

Variable	CPA group (20)		Finasteride group (20)	Control group (20)	Chi square test *P* value
Postoperative haematuria	+ ve	0/20 (0.0%)	0/20 (0.0%)	3/20 (15%)	= 0.042*

† → sig in comparison with controls

‡ → sig in comparison with Finasteride group

and 28% of them received some form of surgical treatment. The most common mechanism of androgen deprivation in reducing prostatic bleeding was believed to be due to inhibition of angiogenesis, which is important process of prostatic growth, whether benign or malignant [16].

Cyproterone acetate has been frequently used in treatment of cancer prostate; also many studies on patients with BPH demonstrated that it causes atrophy, an effect similar to the effect of castration [8].

The effect of preoperative use of cyproterone acetate before TURP was studied by Elgammal et al. who support that the use of CPA decreases perioperative blood loss with TURP by affecting prostate vascularity decreasing the MVD of the prostate [8].

In our study, we assessed the perioperative blood loss by comparing haemoglobin level and haematocrit value before and 24 h after the procedure and estimation of intraoperative blood loss.

Our results showed that the intraoperative blood loss decreased significantly in CPA group than finasteride and control groups, significant drop in haemoglobin and haematocrit value in finasteride and control group in comparison with CPA group. We also assessed the blood loss/gram of resected prostate, blood loss/min of operative time to get more accurate results about intraoperative bleeding and showed significant decrease in CPA group, compared to other groups as there is less intraoperative blood loss with CPA. Three patients in the control group suffered from postoperative haematuria, at the second postoperative day with clot retention and hypotension, tachycardia, anaemia, managed by catheter traction, bladder irrigation by normal saline applied again, one patient received one unit of packed RBCS, haematuria stopped, and the patients improved. No one in finasteride or CPA group need blood transfusion that was explained by decreased prostatic vascularity. These results are mostly consistent with other studies in the literature as Hagerty et al. [11] reported that patients receiving finasteride before surgery required less blood transfusion, with the incidence of perioperative bleeding being 4% compared with 14% in patients who did not receive the drug. Crea et al. [17] reported the efficacy of finasteride on haemorrhage due to BPH and showed that it was markedly lower in patients who had taken finasteride compared with placebo.

Donohue et al. [18] and Ozdal et al. [14] showed that fall in the haemoglobin level and amount of haemorrhage during TURP are significantly higher in the placebo group compared with the finasteride group.

CPA reduced the microvessel density in prostatic tissue more than finasteride and both of them are better than control group, and this also is in accordance with that reported by Elgammal et al. who reported that MVD is significantly reduced after CPA administration and Ozal et al. who reported that MVD is significantly reduced after finasteride administration [8, 19]. Also Hochberg et al. [20] reported that suburethral prostatic MVD significantly decreased in patients with BPH taking finasteride. Bailey et al. [20] noted reduction in prostate stromal MVD in patients on finasteride undergoing TURP. Neal et al. [21] showed that MVD in prostates of canine models pretreated with finasteride decreased by 20 vessels per cm^2.

However, Canda et al. [22] showed that finasteride does not lower MVD and vascular endothelial growth factor expression in rat prostate. They, however, emphasized that the drug reduces haemorrhage in BPH due to its effectiveness in reducing hyperplasia of the gland, which in turn increases vessel wall stability rather than decreasing vascularity of prostate tissue. The meta-analysis done by Zhu et al. [23] showed that treatment with finasteride before TURP for BPH reduces perioperative haemorrhage. Our study is a step forward than others as it compares the efficacy of CPA vs finasteride in preventing blood loss during TURP.

Moreover, the operative time was shorter in CPA group and finasteride group in comparison with the control group and this also was the same as reported by ozal et al. and Elgammal et al. The reduction in operative time resulted from the more clear operative field due to less bleeding, which allowed more resection in less operative duration with less blood loss. Clear operative field also encouraged the surgeon for resecting more prostatic tissue, so we found that the specimen weight in CPA-treated patient and finasteride-treated patient was higher than non-treated patients; similar results are mentioned by Elgammal et al. [8]

Regarding intraoperative complication, the decreased intraoperative bleeding and operative time were reflected by decreased incidence of TURP syndrome as only one patient in control group develops TURP syndrome at the end of the procedure with mild symptoms (restless, mild confusion); serum sodium was 118 mEq/l. The procedure was terminated, the patient was managed by diuretics and 150 ml hypertonic saline and oxygen supply by nasal cannula with no need for intubation or further aggressive management.

In our study, we observed that PSA one month postoperative showed marked decrease by about 60–70% in all groups; this observation is in accordance with that reported by Roberto C et al. who published that PSA decrease by about 63% after one month and 71% after 2 months of preoperative value, and the drop of PSA usually related to the weight of resected tissue [24].

Besides that cyproterone acetate and finasteride were tolerated by our patients without serious side effects and no one of the patients discontinued it.

Limitations of our study were: small numbers due to the strict selection criteria needed and lack of prior research studies on this topic. Further studies can be done in the future with larger number of patients, longer duration of treatment preoperatively and larger prostate sizes.

5 Conclusion

Cyproterone acetate can be safely used before transurethral resection of moderate sized prostate. Cyproterone acetate is better than finasteride in decreasing perioperative bleeding with TURP by decreasing microvascular density of the prostatic tissue.

Abbreviations

BPH: Benign prostatic hyperplasia; TURP: Transurethral resection of prostate;; CPA: Cyproterone acetate; LUTS: Lower urinary tract symptoms; IPSS: The international prostate symptom score; PSA: Prostatic specific antigen; MVD: Microvascular density.

Acknowledgements

Not Applicable.

Authors' contributions

AA has collected the data and finished article writing, SAA performed some TURP operation, AF performed some TURP operation and revised the article, MH has collected the data and statistical analysis, and AA-F processed the translation revision and finalized the article. All authors have read and approved the manuscript.

Funding

Not Applicable.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because that is the policy of our university but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by Research Ethics Committee at Faculty of Medicine, Benha University(REC-FOMBU) which is independent organized committee operating according to international guidelines ,including the Declaration of Helsinki, Islamic Organization For Medical Sciences (IOMS), World Health Organization (WHO) and International Council On Harmonization And Good Clinical Practice(ICH-GCP). No. of ethical committee approval : MS.12.7.2019. Informed written consent has been obtained from all individuals included in this study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

[1]Department of Urology, Faculty of Medicine, Benha University, Qalubeya, Egypt. [2]Kobry el Kobba Military Medical Complex, Cairo, Egypt.

Received: 17 April 2021 Accepted: 11 July 2021
Published online: 22 July 2021

References

1. Pujari NR (2016) Transurethral resection of prostate is still the gold standard for small to moderate sized prostates. J Integr Nephrol Androl 3(2):68
2. Treharne C, Crowe L, Booth D, Ihara Z (2018) Economic value of the transurethral resection in saline system for treatment of benign prostatic hyperplasia in England and Wales: systematic review, meta-analysis, and cost–consequence model. Eur Urol Focus 4(2):270–279
3. Yang TY, Chen M, Lin WR, Li CY, Tsai WK, Chiu AW, Ko MC (2018) Preoperative treatment with 5α-reductase inhibitors and the risk of hemorrhagic events in patients undergoing transurethral resection of the prostate—A population-based cohort study. Clinics (Sao Paulo, Brazil) 73:e264
4. Khwaja MA, Nawaz G, Muhammad S, Jamil MI, Faisal M, Akhter S (2016) The effect of two weeks preoperative finasteride therapy in reducing prostate vascularity. J Coll Phys Surg Pak 26(3):213–215
5. Bansal A, Arora A (2017) Transurethral resection of prostate and bleeding: a prospective, randomized, double-blind placebo-controlled trial to see the efficacy of short-term use of finasteride and dutasteride on operative blood loss and prostatic microvessel density. J Endourol 31(9):910–917
6. Schröder FH (1993) Cyproterone acetate--mechanism of action and clinical effectiveness in prostate cancer treatment. Cancer 72(S12):3810–3815
7. Bosch RJ, Griffiths DJ, Blom JH, Schroeder FH (1989) Treatment of benign prostatic hyperplasia by androgen deprivation: effects on prostate size and urodynamic parameters. J Urol 141(1):68–72
8. El-Gamal OM, Gameel TA, Ghoneem A, Soliman MG, Abo-El-Enen M, El-Hitham AA, El-Rasheedy M, Elbendary MA, Sabaa M (2015) Perioperative use of cyproterone acetate with transurethral resection of large prostate: preliminary results. J Endourol 29(5):569–574
9. El-Enen MA, Tawfik A, El-Abd AS, Ragab M, El-Abd S, Elrashidy M, El-Abd S (2016) Goserelin acetate before transurethral resection of moderately enlarged benign prostatic hyperplasia: Prospective randomised-controlled clinical trial. Arab J Urol 14(1):59–65
10. Marshall S, Narayan P (1993) Treatment of prostatic bleeding: suppression of angiogenesis by androgen deprivation. J Urol 149(6):1553–1554
11. Hagerty JA, Ginsberg PC, Harmon JD, Harkaway RC (2000) Pretreatment with finasteride decreases perioperative bleeding associated with transurethral resection of the prostate. Urology 55(5):684–687
12. Eri LM, Tveter KJ (1993) A prospective, placebo-controlled study of the antiandrogen Casodex as treatment for patients with benign prostatic hyperplasia. J Urol 150(1):90–94
13. Foley SJ, Soloman, I. Z., Wedderburn, A. W., Kashif, k. M., Summerton, D., Basketter, V., & Holmes, S. A. (2000) A prospective study of the natural history of hematuria associated with benign prostatic hyperplasia and the effect of finasteride. J Urol 163(2):496–498
14. Özdal ÖL, Özden C, Benli K, Gökkaya S, Bulut S, Memiş A (2005) Effect of short-term finasteride therapy on peroperative bleeding in patients who were candidates for transurethral resection of the prostate (TUR-P): a randomized controlled study. Prostate Cancer Prostatic Dis 8(3):215–218
15. Donohue JF, Hayne D, Karnik U, Thomas DR, Foster MC (2005) Randomized, placebo-controlled trial showing that finasteride reduces prostatic vascularity rapidly within 2 weeks. BJU Int 96(9):1319–1322
16. Perimenis P, Gyftopoulos K, Markou S, Barbalias G (2002) Effects of finasteride and cyproterone acetate on hematuria associated with benign prostatic hyperplasia: a prospective, randomized, controlled study. Urology 59(3):373–377
17. Crea G, Sanfilippo G, Anastasi G, Magno C, Vizzini C, Inferrera A (2005) Presurgical finasteride therapy in patients treated endoscopically for benign prostatic hyperplasia. Urol Int 74(1):51–53
18. Donohue JF, Sharma H, Abraham R, Natalwala S, Thomas DR, Foster MC (2002) Transurethral prostate resection and bleeding: a randomized, placebo controlled trial of role of finasteride for decreasing operative blood loss. J Urol 168(5):2024–2026
19. Memis A, Ozden C, Ozdal OL, Guzel O, Han O, Seckin S (2008) Effect of finasteride treatment on suburethral prostatic microvessel density in patients with hematuria related to benign prostate hyperplasia. Urol Int 80(2):177–180

20. Hochberg DA, Basillote JB, Armenakas NA, Vasovic L, Shevchuk M, Pareek G, Fracchia JA (2002) Decreased suburethral prostatic microvessel density in finasteride treated prostates: a possible mechanism for reduced bleeding in benign prostatic hyperplasia. J Urol 167(4):1731–1733
21. Kaplan SA (2019) Re: Transurethral Resection of Prostate and Bleeding: A Prospective, Randomized, Double-Blind Placebo-Controlled Trial to See the Efficacy of Short-Term Use of Finasteride and Dutasteride on Operative Blood Loss and Prostatic Microvessel Density. J Urol 201(2):202–202
22. Canda AE, Mungan MU, Yilmaz O, Yorukoglu K, Tuzel E, Kirkali Z (2006) Effects of finasteride on the vascular surface density, number of microvessels and vascular endothelial growth factor expression of the rat prostate. Int Urol Nephrol 38(2):275–280
23. Zhu YP, Dai B, Zhang HL, Shi GH, Ye DW (2015) Impact of preoperative 5α-reductase inhibitors on perioperative blood loss in patients with benign prostatic hyperplasia: a meta-analysis of randomized controlled trials. BMC Urol 15(1):1–11
24. Fonseca RC, Gomes CM, Meireles EB, Freire GC, Srougi M (2008) Prostate specific antigen levels following transurethral resection of the prostate. Int Braz J Urol 34(1):41–48

Publisher's Note