Transurethral plasmakinetic resection of the prostate is a reliable minimal invasive technique for benign prostate hyperplasia: a meta-analysis of randomized controlled trials

Kai Wang1,2*, Yao Li2*, Jing-Fei Teng3, Hai-Yong Zhou1, Dan-Feng Xu2, Yi Fan1

To evaluate the efficacy and safety of plasmakinetic resection of the prostate (PKRP) versus transurethral resection of the prostate (TURP) for the treatment of patients with benign prostate hyperplasia (BPH), a meta-analysis of randomized controlled trials was carried out. We searched PubMed, Embase, Web of Science and the Cochrane Library. The pooled estimates of maximum flow rate, International Prostate Symptom Score, operation time, catheterization time, irrigated volume, hospital stay, transurethral resection syndrome, transfusion, clot retention, urinary retention and urinary stricture were assessed. There was no notable difference in International Prostate Symptom Score between TURP and PKRP groups during the 1-month, 3 months, 6 months and 12 months follow-up period, while the pooled Qmax at 1-month favored PKRP group. PKRP group was related to a lower risk rate of transurethral resection syndrome, transfusion and clot retention, and the catheterization time and operation time were also shorter than that of TURP. The irrigated volume, length of hospital stay, urinary retention and urinary stricture rate were similar between groups. In conclusion, our study suggests that the PKRP is a reliable minimal invasive technique and may anticipatorily prove to be an alternative electrosurgical procedure for the treatment of BPH.

Asian Journal of Andrology (2015) 17, 135–142; doi: 10.4103/1008-682X.138191; published online: 03 October 2014

Keywords: benign prostate hyperplasia; lower urinary tract symptoms; plasmakinetic resection of prostate; transurethral resection of prostate

INTRODUCTION

Lower urinary tract symptoms or LUTS is a common age-related disease affecting men. Enlargement of the prostate gland is mainly due to a histopathological condition known benign prostate hyperplasia (BPH), which is considered the main reason of LUTS and usually develops beyond the fourth decade of life, affecting about 50% men by the age of 60 years and 90% by the age of 85 years.1,2 However, the statistic data in China show that the percentage of BPH in men aged 60 years is about 50%, and this figure rises to 83% in men aged 80 years.3

Various therapies are available for the treatment of BPH-related LUTS, including follow-up, drugs and surgical intervention.1,4 Surgical treatment includes minimally invasive and open prostatectomy. Despite advances in minimally invasive therapies, transurethral resection of the prostate (TURP) remains the gold standard for treatment of BPH and represents one of the most common surgeries in the Western world.2,5 Nevertheless, TURP-associated morbidity rate was reported to be 15%–18%, including clot retention, urethral stricture and TUR syndrome, etc.6–11 This high morbidity rate fueled the interests of investigators to search for alternative procedures.

Plasmakinetic resection of prostate (PKRP) is a newly developed method in the field of transurethral surgery that uses bipolar energy to resect the enlarged prostate gland.12 The plasmakinetic system enables to resect or vaporize the prostate tissue by creation of an ionized plasma corona, using an axipolar electrode and electro-conductive solutions.13 The active and return electrodes of the loop bend in the same axis. The use of normal saline irrigation (NaCl 0.9%) instead of mannitol solution to decrease the morbidity associated with TUR syndrome, and prolonged resection time are the two main supposed advantages. However, the real advantage of PKRP over conventional TURP and whether PKRP can replace TURP as the first-line urological intervention remain to be determined. The aim of this meta-analysis was to evaluate these two techniques by comparing the efficacy and safety in patients with BPH-related-LUTS.

PATIENTS AND METHODS

Publication search

Relevant studies were identified and selected by searching the electronic databases, PubMed, Embase, Web of Science and the Cochrane Library

1Department of Urology, Zhejiang Xiaoshan Hospital, Hangzhou 311202, China; 2Department of Urology, Shanghai Changzheng Hospital, Second Military Medical University, Shanghai 200003, China; 3Department of Urology, General Hospital of Beijing Military Command, Beijing 100700, China.

*These authors contributed equally to this work.

Correspondence: Dr. Y Fan (fanyi@zjxsh.com) or Dr. DF Xu (xu-danfeng@hotmail.com)

Received: 08 February 2014; Revised: 29 April 2014; Accepted: 21 July 2014
under the search words “pasmakinetic resection of the prostate,” “PKRP,” “TURP” and “TURP.” We also did a full manual search of references in each relevant article. The article language was restricted to English only. All relevant studies comparing PKRP and TURP were selected in further screening (Table 1).

Table 1: Searching strategies and results

| Database      | Date         | Search strategy                                      | Results |
|---------------|--------------|------------------------------------------------------|---------|
| PubMed        | Up to April 2014 | Plasmakinetic AND (“transurethral resection of the prostate” or TURP) | 72      |
| Embase        | Up to April 2014 | Plasmakinetic: abstract, title AND (“transurethral resection of the prostate”: abstract, title) | 81      |
| Web of science | Up to April 2014 | TS=Plasmakinetic AND TS=(“transurethral resection of the prostate”: abstract, title) | 67      |
| Cochrane library | Up to April 2014 | Plasmakinetic AND (“transurethral resection of the prostate” or TURP) | 26      |

Table 2: Baseline characteristics of included studies

| Studies       | Treatments | Number of patients | $Q_{\text{max}}$ (ml s$^{-1}$) | PVR (ml) | QoL | IPSS | Publication type | Jadad score |
|---------------|------------|--------------------|---------------------------------|----------|-----|------|-----------------|-------------|
| Iori et al.   | TURP       | 26                 | 8.7±2                           | 96±97    | 3.6±1| 20±4 | RCT             | 3           |
|               | PKRP       | 27                 | 7±1                             | 99±58    | 3±1 | 21±2 |                 |             |
| Seckiner et al.| TURP       | 24                 | 8.3±3.1                         | 138±115  | 23.2±4.9 | 24.1±5.2 | RCT             | 3           |
|               | PKRP       | 24                 | 8.5±2.9                         | 88±74    | 24.1±5.2 | 24.1±5.2 |                 |             |
|Autorino et al.| TURP       | 35                 | 6.2±3                           | 75±35.5  | 3.9±1| 24.3±5 | RCT             | 3           |
|               | PKRP       | 35                 | 7.1±2                           | 80±22.5  | 4.2±1| 24.2±4 |                 |             |
| Bhansali et al.| TURP      | 33                 | 4.194±1.5046                   |          |     |      | RCT             | 3           |
|               | PKRP       | 34                 | 4.367±1.1813                   |          |     |      |                 |             |
| Nuhoglu et al.| TURP       | 30                 | 7.3±2.1                         | 88±20    | 17.3±5.8 | 24.3±5 | RCT             | 3           |
|               | PKRP       | 27                 | 6.9±2.8                         | 96±27    | 17.6±6.1 | 24.1±5.2 |                 |             |
| Patankar et al.| TURP      | 51                 | 6.4±1.77                        |          |     |      | RCT             | 3           |
|               | PKRP       | 52                 | 5.9±1.98                        |          |     |      |                 |             |
| de Sio et al. | TURP       | 35                 | 6.3±3                           | 75±35.5  | 3.9±1| 24.3±5 | RCT             | 3           |
|               | PKRP       | 35                 | 7.1±2                           | 80±22.5  | 4.2±1| 24.18±4 |                 |             |
| Erturhan et al.| TURP      | 120                | 9.2±1.7                         | 135±25   | 3±1 | 23±5 | RCT             | 3           |
|               | PKRP       | 120                | 10.9±1.2                        | 114±19   | 2±1 | 23±5 |                 |             |
| Lv et al.     | TURP       | 136                | 7.2±1.4                         | 75.5±20.2| 4.9±1.0| 27.2±3.0 | RCT             | 3           |
|               | PKRP       | 193                | 7.4±1.1                         | 74.9±18.6| 4.7±0.8| 27.6±3.5 |                 |             |
| Sinanoglu et al.| TURP     | 85                 | 8.5±2.73                        | 120.8±59 | 18.6±7.8 | RCT             | 3           |
|               | PKRP       | 80                 | 8.4±4.2                         | 131.2±74.3| 25.6±7.6 |                 |             |
| Huang et al.  | TURP       | 65                 | 6.95±2.47                       | 4.14±0.95| 22.09±3.72 | RCT             | 3           |
|               | PKRP       | 71                 | 6.73±2.43                       | 4.23±0.87| 23.38±3.64 |                 |             |
| Tefekli et al. | TURP      | 47                 | 8.3±3.6                         |          |     |      | RCT             | 3           |
|               | PKRP       | 47                 | 7.8±3.7                         |          |     |      |                 |             |
| Giulianelli et al.| TURP    | 80                 | 6.5±4.8                         | 187±195  | 3.0±2.5| 23.4±1.8 | RCT             | 3           |
|               | PKRP       | 80                 | 8.9±2.9                         | 243±241.6| 3.3±2.1| 22.3±3.2 |                 |             |
| Akçayöz et al.| TURP       | 21                 |                                 |          |     |      | RCT             | 3           |
|               | PKRP       | 21                 |                                 |          |     |      |                 |             |
| Kong et al.   | TURP       | 51                 | 4.60±1.61                       | 103±24.83| 4.51±0.76| 23.9±4.32 | RCT             | 3           |
|               | PKRP       | 51                 | 4.99±1.48                       | 107±28.01| 4.47±0.81| 23.3±4.77 |                 |             |
| Yoon et al.   | TURP       | 53                 | 8.4±2.0                         |          |     |      | RCT             | 3           |
|               | PKRP       | 49                 | 8.7±2.7                         |          |     |      |                 |             |
| Engler et al. | TURP       | 101                | 9.1±6.2                         | 195±361  | 3.6±1.7| 18.2±5.5 | RCT             | 3           |
|               | PKRP       | 111                | 8.3±4.9                         | 186±253  | 3.0±2.1| 18.4±6.2 |                 |             |

PKRP: transurethral resection of the prostate; PKRP: transurethral plasmakinetic resection of the prostate; PVR: postvoiding residual; QoL: quality of life; IPSS: International Prostatic Symptom Score; RCTs: randomized controlled trials

Inclusion and exclusion criteria
The following inclusion criteria were applied: (i) randomized clinical trials (RCTs) comparing PKRP and TURP; (ii) BPH with LUTS; and (iii) the International Prostate Symptom Score (IPSS) ≥8 and a maximum flow rate ($Q_{\text{max}}$) <15 ml s$^{-1}$. The exclusion criteria were documented or suspected prostate carcinoma and neurogenic bladder disorders.

Quality assessment of included studies
Two primary investigators completed this procedure from sources mentioned above and all disagreements were resolved by consensus. The methodological quality of RCTs included was scored with the Jadad composite scale. This is a five-point scale, where a score ≤ 2 indicates a low quality while a score ≥ 3 indicates a high quality. This procedure was independently carried out by two investigators, and any disagreement was resolved by consensus.

Data extraction
Two investigators identified and enrolled all the relevant studies from the sources mentioned above according to the inclusion criteria. Data were extracted and tabulated from each
eligible article. The following variables were involved: authors, journal and year of publication, number of patients, \( Q_{\text{max}} \), IPSS, operation time, catheterization, hospital stay, irrigated volume, clot retention, transfusion, TUR syndrome, urethral stricture and urinary retention.

**Statistical analysis**

A formal meta-analysis was made of all RCTs comparing the efficacy and safety of PKRP with those of TURP treating patients with LUTS/BPH. Review Manager Software (version 5.1 Cochrane Collaboration, Oxford, UK) was used to analyze the risk ratio for dichotomous outcomes and mean or standardized mean difference for continuous data, with 95% confidence intervals. When the heterogeneity appears in a meta-analysis, a random-effect model (DerSimonian-Laird method) was used to calculate pooled estimates; otherwise, a fixed-effect model (Mantel-Haenszel method) was applied according to heterogeneity.\(^{19}\) The significance of pooled effects was determined by the \( Z \)-test and \( P < 0.05 \) was considered to display statistical significance.\(^{20,21}\) The Cochrane Chi-squared test was used to assess the heterogeneity between trials and the inconsistency (\( I^2 \)) statistic to assess the extent of the inconsistency. \( P < 0.10 \) was considered as the presence of heterogeneity while \( I^2 \) was considered acceptable heterogeneity.

**RESULTS**

We identified 133 potential articles after a primary search in the database, and 18 RCTs,\(^{22–39}\) including a total of 2119 patients enrolled in this meta-analysis (Figure 1). Table 2 summarizes the preoperative baseline characteristics of included studies. The results of quality assessment of RCTs are shown in Table 3. The 18 RCTs all got a Jadad score of 3, because it was not possible to make double-blinding for RCTs. There were no significant differences in IPSS between the two groups at 1-month, 3 months, 6 months and 12 months after operation (Figure 2). The pooled \( Q_{\text{max}} \) at 1-month suggesting that the PKRP group was statistically superior to that of TURP group, but the pooled \( Q_{\text{max}} \) between the two groups at 3 months, 6 months, 12 months was no noticeable differences. However, the heterogeneity between the studies was clear (Figure 3).

Catheterization was remarkably less frequent in PKRP group than that in TURP group, operation time and hospital stay was shorter in PKRP group, while there was no notable difference in other perioperative data such as irrigated volume between the two groups. In addition, there was great heterogeneity between the studies (Figure 4).

There was a remarkable difference in TUR syndrome, clot retention and transfusion rate between TURP and PKRP groups. However, there was no notable difference in urinary retention and urethral stricture between the two groups (Figure 5). There was no heterogeneity.

![Figure 1: Flowchart showing the selection of studies for meta-analysis.](image)

**Table 3: The Jadad scale for quality assessment of RCTs**

| Studies        | Was the study described as randomized (e.g., using the words randomly, random and randomization)? | Was the method of randomization described and appropriate (e.g., table of random numbers, computer-generated)? | Was the study described as double-blind? | Was the method of blinding described and appropriate (e.g., identical placebo, active placebo, dummy)? | Was there a description of withdrawals and dropouts? | Total |
|----------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------|
| Iori et al.\(^{22}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Seckiner et al.\(^{29}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Autorino et al.\(^{24}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Bhansali et al.\(^{25}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Muslimamanoglu et al.\(^{26}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Nuhoglu et al.\(^{23}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Patankar et al.\(^{24}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| de Sio et al.\(^{27}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Erterhan et al.\(^{27}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Lv et al.\(^{24}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Sinanoglu et al.\(^{25}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Huang et al.\(^{23}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Tefekli et al.\(^{26}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Giulianelli et al.\(^{32}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Akçayöz et al.\(^{30}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Kong et al.\(^{29}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Yoon et al.\(^{26}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |
| Engeler et al.\(^{31}\) | 1                                                                                               | 1                                                                                               | 0                                      | 0                                                                                               | 1                                                                                               | 3     |

RCTs: randomized clinical trials
DISCUSSION

Although, TURP is considered safe and effective method for the treatment of LUTS secondary to BPH and has been regarded as the reference standard for decades, its morbidity and related mortality remain a clinical challenge for urologists. Many attempts have been made to search surgical alternatives or advance new resectoscope and electrosurgical devices such as holmium laser enucleation of the prostate, photoselective vaporization of the prostate and thulium laser resection of the prostate, all of which are considered extremely promising technologies. 40–42

Plasmakinetic resection of the prostate is another novel electrosurgical technique that was first used for BPH therapy in 2001. 23 Many studies have already proven the efficacy and safety of PKRP.22–29 In our meta-analysis, we have displayed the overall efficacy and safety of PKRP compared with TURP.

Monopolar TURP has a limitation in treating large prostates, especially those larger than ≥ 80 ml, because it requires a longer operation time. In addition, some irrigation fluid may enter the circulation via the prostate blood vessels opened, eventually leading to the development of the TUR syndrome. Although rare, TUR syndrome is the most dreaded complication of monopolar TURP. The Gyrus PlasmaKinetic System uses a bipolar coaxial system with an active and return electrodes placed on the same axis separated by a ceramic insulator, 24 so the system permits an effective operation because it is immersed in conductive normal saline as the irrigation fluid rather than in glycine or sorbitol. As a result, it decreases the risk of dilutional hyponatremia and TUR syndrome. The present meta-analysis showed that the PKRP group was remarkable shorter in operation time. The reason may be that urologists were now skilled in PKRP, compared with TURP. The rate of TUR syndrome was notably lower in PKRP.
group than that in TURP group. None of 595 patients in PKRP group developed TUR syndrome. This could be an advantage for procedures with large prostate glands. The early irritative symptoms and urinary retention were mainly attributed to urethral edema and obstruction of the residual prostate tissue. There was no statistical difference in the two complications between the two groups. However, there was more clot retention in TURP group than that in PKRP group because of greater thermal damage and more granulation tissue induced by the monopolar current.

Although the catheterization time in PKRP group was remarkably shorter than that in TURP group, there was no statistical difference in bladder irrigation volume between the two groups ($P = 0.14$), nor was there statistical difference in hospital stay ($P = 0.04$). The pooled estimates of our meta-analysis gave similar results for PKRP and TURP in IPSS (1-month, 3 months, 6 months and 12 months), but the $Q_{max}$ (1-month) was noticeably higher in PKRP group.

Some authors have argued about excessive blood loss in conventional TURP. Bhansali et al. reported that blood loss in TURP group was remarkably higher than that in PKRP, and even higher in cases of larger prostate glands. Nuhoglu et al. believed that less bleeding should be expected in PKRP technique because it both resects the prostate tissue and can controls bleeding. de Sio et al. reported that the mean decrease in hemoglobin level 24 h after operation was lower in PKRP, though the difference was not statistically notable when compared with TURP group.

There are two limitations in our meta-analysis. First, the follow-up periods were not long enough. Only one study reported a 100 months follow-up.
PKRP versus TURP for benign prostate hyperplasia

K Wang et al

Figure 4: Pooled estimates of perioperative variables.

**CONCLUSION**

The advantage of PKRP over TURP seems to lie in decreasing the risk of TUR syndrome, reducing the time of operation, catheterization and hospital stay, lowering the incidence of transfusion and clot retention, and increasing $Q_{\text{max}}$ (1-month). IPSS (1-month, follow-up period, while the other studies had only 1-year follow-ups without including PVR and QoL. Thus, we were unable to evaluate the long-term efficacy and safety of PKRP. Secondly, the complications were not described sufficiently, such as sexual dysfunction, bladder neck contracture and the re-intervention rate.
PKRP versus TURP for benign prostate hyperplasia
K Wang et al

3 months, 6 months and 12 months), Q\textsubscript{max} (3 months, 6 months and 12 months), urinary retention rate, urinary stricture rate, irrigation volume in PKRP group were similar to those in TURP group. PKRP may anticipatorily prove to be a reliable minimal invasive technique and an alternative electrosurgical procedure for treating BPH.
AUTHOR CONTRIBUTIONS
KW and YL contributed to the conception, design, acquisition, analysis and interpretation of data, drafting the manuscript, critical revision for important intellectual content. JFT participated in the design of the study and performed the statistical analysis. HYZ contributed to the acquisition of data. DFX and YF evaluated the results and supervised the project. All authors read and approved the final manuscript.

COMPETING FINANCIAL INTERESTS
All authors declare no competing interests.

REFERENCES
1. Roberts RO, Jacobsen SJ, Jacobson DJ, Reilly WT, Talley NJ, et al. Natural history of prostatism: high American Urological Association Symptom scores among community-dwelling men and women with urinary incontinence. J Urol 1998; 160: 213–9.
2. Roehrborn CG, McConnell J, Bonilla J, Rosenblatt S, Hudson PB, et al. Serum prostate specific antigen is a strong predictor of future prostate growth in men with benign prostatic hyperplasia. PROSCAR long-term efficacy and safety study. J Urol 2000; 163: 13–20.
3. Gu FL, Xia TL, Kong XT. Preliminary study of the frequency of benign prostatic hyperplasia and prostatic cancer in China. Urology 1994; 44: 688–91.
4. Plante M, Wachterman J, Perrapato S. Options for the treatment of benign prostatic hyperplasia. Crit Rev Eukaryot Gene Expr 2012; 22: 281–7.
5. Kumar R, Malla P, Kumar M. Advances in the design and discovery of drugs for the treatment of prostatic hyperplasia. Expert Opin Drug Discov 2013; 8: 1013–27.
6. Wasson JH, Reda DJ, Bruskewitz RC, Elkins J, Keller AM, et al. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. The Veterans Affairs Cooperative Study Group on Transurethral Resection of the Prostate. N Engl J Med 1995; 332: 75–9.
7. Wei JT, Calhoun E, Jacobsen SJ. Urologic diseases in America project: benign prostatic hyperplasia. J Urol 2005; 173: 1256–61.
8. McCay KT, Roehrborn CG, Avis LN, Barry MJ, Bruskewitz RC, et al. Update on AUA guideline on the management of benign prostatic hyperplasia. J Urol 2011; 185: 1793–803.
9. Herrmann TR, Liatsikos EN, Nagele U, Traxer O, Merseburger AS. AUA guidelines panel on lasers, technologies. AUA guidelines on laser technologies. Eur Urol 2012, 61; 783–95.
10. Bostanci Y, Kazzazi A, Djavan B. Laser prostatectomy: holmium laser enucleation of the prostate (TURP) – incidence, management, and prevention. BJU Int 2003; 85: 1288–95.
11. Mebusk WK, Holgrew HL, Cockett AT, Peters PC. Transurethroprostectomy: immediate and postoperative complications. A cooperative study of 13 participating institutions evaluating 3,885 patients 1989. J Urol 2002; 167: 999–1003.
12. Ravussi J, Teber D, Hoffer M, Hofmann R. Complications of transurethral resection of the prostate (TURP) – incidence, management, and prevention. Eur Urol 2006; 50; 969–79.
13. Zhu G, Xie C, Wang X, Tang X. Bipolar plasmakinetic transurethral resection of prostate in 138 consecutive patients with large gland: three-year follow-up results. Urology 2012; 79: 397–402.
14. Simpson RJ. Benign prostatic hyperplasia. Br J Gen Pract 1997; 47: 237–40.
15. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Control Clin Trials 1996; 17: 1–12.
16. Kjaergard LL, Villumsen J, Gluud C. Reported methodologic quality and discrepancies between large and small randomized trials in meta-analyses. Ann Intern Med 2001; 135: 113–8.
17. Moher D, Pham B, Jones A, Cook DJ, Jadad AR, et al. Does quality of reports of randomised trials affect estimates of intervention efficacy reported in meta-analyses? Lancet 1998; 352: 609–13.
18. Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of disease. J Natl Cancer Inst 1959; 22: 719–48.
19. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials 1986; 7: 177–88.
20. Aurelio T. Assessing the influence of a single study in the meta-analysis estimate. Stat Tech Bull 1999; 8: 15–7.
21. Iori F, Franco G, Leonardo C, Laurenti C, Tabaro A, et al. Bipolar transurethral resection of prostate: clinical and urodynamic evaluation. Urology 2008; 71: 252–5.
22. Nuhoglu B, Aydiliz A, Karagöz E, Cebeci O, Gerimyanoglu C. Plasmakinetic prostate resection in the treatment of benign prostate hyperplasia: results of 1-year follow-up. Int J Urol 2006; 13: 21–4.
23. Autorino R, Damiano R, Di Lorenzo G, Quarto G, Perdonà S, et al. Four-year outcome of a prospective randomised trial comparing bipolar plasmakinetic and monopolar transurethral resection of the prostate. Eur Urol 2009; 55: 922–9.
24. Bhanasali M, Patankar S, Dobhada S, Khaladkar S. Management of large (>60 g) prostate gland: plasmakinetic superpulse (bipolar) versus conventional (monopolar) transurethral resection of the prostate. J Endourol 2009; 23: 141–5.
25. Mulsumanoglu AT, Yuruk E, Binbay M, Akman T. Transurethral resection of prostate with plasmakinetic energy. 100 months results of a prospective randomized trial. BJU Int 2012; 110: 546–9.
26. Erturhan S, Erbagci I, Seckiner I, Yagci F, Ustun A. Plasmakinetic resection of the prostate versus standard transurethral resection of the prostate: a prospective randomized trial with 1-year follow-up. Prostate Cancer Prostatic Dis 2007; 10; 97–100.
27. Patankar S, Jamkar A, Dobhada S, Gorde V. Plasmakinetic Superpulse transurethral resection versus conventional transurethral resection of prostate. J Endourol 2006; 20: 215–9.
28. Seckiner I, Yesilci C, Akduman B, Altan K, Mungan NA. A prospective randomized study for comparing bipolar plasmakinetic resection of the prostate with standard TURP. Urol Int 2006; 76: 139–43.
29. Akgöz Y, Kaygısiz O, Akdemir O, Aki FT, Adsan O, et al. Comparison of plasmakinetic resection and plasmakinetic transurethral resection applications with regard to fluid absorption amounts in benign prostate hyperplasia. Urol Int 2006; 77: 143–7.
30. Engeler DS, Schwab C, Neyer M, Grun T, Reissigl A, et al. Bipolar versus monopolar TURP: a prospective controlled study at two urology centers. Prostate Cancer Prostatic Dis 2010; 13: 285–91.
31. Giulianelli R, Albanesi L, Attisani F, Gentile BC, Vincenzi G, et al. Comparative randomised study on the efficaciousness of endoscopic bipolar prostate resection versus monopolar resection technique 3 year follow-up. Arch Ital Urol Androl 2013; 85: 86–91.
32. Huang X, Wang L, Wang XH, Shi HB, Zhang XJ, et al. Bipolar transurethral resection of the prostate causes deeper coagulation depth and less bleeding than monopolar transurethral prostatectomy. Urol Int 2012; 80: 116–20.
33. Li L, Wang L, Fan M, Ju W, Pang Z, et al. Two-year outcome of high-risk benign prostate hyperplasia patients treated with transurethral prostate resection by plasmakinetic or conventional procedure. Urol Int 2012; 80: 389–94.
34. Siangaloi O, Eksi C, Satar MN, Turan G, Keles A, et al. Postoperative outcomes of plasmakinetic transurethral resection of the prostate compared to monopolar transurethral resection. J Endourol 2012; 26: 1017–22.
35. Patankar S, Jamkar A, Dobhada S, Gorde V. Plasmakinetic Superpulse transurethral resection in patients with comorbidities. Urol Int 2012; 80: 402–6.
36. Tefekli A, Mulsumanoglu AT, Baykal M, Binbay M, Tast, et al. A hybrid technique using bipolar energy in transurethral prostate surgery: a prospective, randomized comparison. J Urol 2009; 181: 1349–43.
37. de Sil M, Autorino R, Quarto G, Damiano R, Perdonà S, et al. Gyrus bipolar versus standard monopolar transurethral resection of the prostate: a randomized prospective trial. Urol 2006; 67: 69–72.
38. Yoon CJ, Kim JM, Moon KH, Jung HC, Park TC. Transurethral resection of the prostate with a bipolar tissue management system compared to conventional monopolar resectoscope: one-year outcome. Yonsei Med J 2006; 47: 715–20.
39. Lur L, Wang L, Fan M, Ju W, Pang Z, et al. A comparison of transurethral resection of prostate: plasmakinetic superpulse versus conventional monopolar transurethral resection of the prostate in treatment of benign prostatic hyperplasia. Ann Saudi Med 2009; 29: 429–32.
40. Yin L, Teng J, Huang CJ, Zhang X, Xu D. Holmium laser enucleation of the prostate versus transurethral resection of the prostate: a systematic review and meta-analysis of randomized controlled trials. J Endourol 2013; 27: 604–11.
41. Mohanty NK, Vasudeva P, Kumar M, Prakash S, Jain M, et al. Photoselective vaporization of prostate vs. Transurethral resection of prostate: a prospective, randomized study with one year follow-up. Indian J Urol 2012; 28: 307–12.