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Original Research

Ligation-free single scrotal incision orchiectomy with ultrasonic scalpel: Xinhua Zhang Procedure

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Abstract

Background: To explore the efficacy and safety of a new type of testicular excision with ultrasonic dissector.

Methods: A retrospective analysis was performed on 69 patients with advanced prostate cancer undergoing orchiectomy in our hospital between June 2017 and June 2019. All patients were divided into a traditional surgery group (n = 27) and an ultrasonic scalpel surgery group (n = 42). The operation time, intraoperative blood loss, postoperative hospital stay and postoperative complication rates were compared.

Results: The ultrasonic scalpel surgery group had significantly shorter operation times and less intraoperative blood loss than the traditional surgery group (each $P < 0.01$). Moreover, the incidence of postoperative complication differed significantly between the traditional surgery group (18.52%) and the ultrasonic scalpel surgery group (0%) ($P < 0.01$). However, there was no significant difference in postoperative hospital stay between the two groups ($P > 0.05$).

Conclusions: The surgery time for testicular excision using the ultrasonic knife is short, the operation is simple and the complications are few and thus it may become a form of replacement for traditional testicular excision.

Keywords

Ultracision; Orchiectomy; Novel procedure

1. Introduction

Orchiectomy is a common surgical procedure in urology. Its indications include testicular torsion, testicular tumors [1], hidden testicular cancer [2] and surgical castration for advanced prostate cancer. Androgen deprivation with drugs or surgical castration are the main treatments for advanced prostate cancer. The financial burden of drug treatment has led some patients to opt for surgery, the most common being a double-sided testicular excision. The traditional testicular excision is performed by incising the front side wall of the scrotum, cutting open the scrotum muscle film layer, lifting the testicular muscle layer and membrane layer, peeling off the vas deferens, and tying the ends and then the middle part decays. The remaining region is divided into one or several bundles of clamped and closed ends, and then the middle decays (the same method for side-to-side operation), and then closing the deep tissue and skin incision. Common complications include infection, scrotum edema, scrotum hematoma, scrotum pain, etc. [3, 4].

2. Materials and methods

2.1 General information

A retrospective analysis was performed on 69 patients diagnosed with advanced prostate cancer and undergoing orchiectomy in Zhongnan Hospital of Wuhan University from June 2017 to June 2019. All patients were divided into a traditional surgery group and an ultrasonic scalpel surgery group. The average age of the 27 patients in the traditional surgery group was (68.3 $\pm$ 5.9) years, ranging from 52 to 80 years

old. In the ultrasound scalpel operation group, 42 patients were aged 49~77 years, with an average age of (67.8 ± 6.7) years. The age difference between the two groups was not statistically significant ($P > 0.05$), indicating comparability. None of the patients had any history of taking anticoagulant drugs or antiplatelet drugs prior to surgery that affects blood clotting function. All cases were pathologically diagnosed as advanced prostate cancer. Preoperative communication was conducted with the patient and his/her authorized relatives to inform the patient of disease information, advantages and disadvantages of the operation and possible complications during and after the operation. Next, all subjects signed their informed consent form for inclusion prior to participating in the study. The study was conducted in accordance with the WMA's Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Zhongnan Hospital of Wuhan University.

2.2 Surgical methods

The ultrasonic knife used to perform the surgery was manufactured by Beijing Anhe Jiali Technology (Co., LTD.; Model: AH-631-L).

The surgical incision is made on the outer side of the one-sided scrotum and is a 3.0 cm incision. Then the assistant clamped the same side of the testicles and pushed in the incision's direction, the blade cut open the scrotum skin, the ultrasonic knife cuts the scrotum and the testicular muscle layer until part of the testicular membrane is cut, at which point liquid can be seen flowing out of the gap next to the testes, and then the testicular membrane incision is extended to both sides until the entire testicle is exposed. Without the need to separate the spermatic cord and blood vessels from each other, the ultrasonic knife is used to cut and solidify along the root of the cord tissue until the complete separation of the testicles on the same side is achieved. At this point the assistant uses the thumb and pointing finger to push the opposite testicles, the ultrasonic knife opens the testicles to expose the opposite testicular tissue, and then operation is carried out in the same way as described above. After surgery, there is no need to keep the rubber sheet or drainage tube and intermittent suturing to close the scrotum membrane layer and skin incision.

2.3 Observation and quantitation

The operative time, intraoperative blood loss, postoperative hospital stay, and postoperative complication rate of the patients are recorded. Postoperative complications included incision infection, scrotal edema, scrotal hematoma, and scrotal pain.

2.4 Statistical methods

Statistical analyses were performed using SPSS version 21.0 software for data analysis, the measurement data to $\overline{x} \pm s$, and the count data to rate.

3. Results

3.1 Comparison of surgical parameters between the two groups

The operative time and intraoperative blood loss of the ultrasonic scalpel operation group were smaller than that of the traditional surgery group, and the differences were both statistically significant ($P < 0.01$). There was no significant difference in postoperative hospital stay between the two groups ($P > 0.05$) (Table 1).

3.2 Comparison of postoperative complications between the two groups

In the traditional surgery group, there were 2 cases of postoperative scrotal edema, 1 case of scrotal hematoma and 2 cases of scrotal pain, and the incidence of complications was 18.52% (5/27). The complication rate of the ultrasonic scalpel operation group was 0% (0/42). The complication rate of the ultrasonic scalpel surgery group was lower than that of the traditional surgery group, and the difference was statistically significant ($P < 0.05$).

4. Discussion

Testicular excision is a common surgical method in urology, and its indications include testicular torsion, testicular tumors, hidden testicles, testicular cancer and surgical deconditioning for advanced prostate cancer. Traditional surgical methods emphasize the complete stripping and ligation of the vas deferens and nerves, which can lead to stubborn pain in the scrotum which will severely affect the quality of life of patients. For the first time, an ultrasonic knife has been used in testicular excision. Ultrasonic knives are widely used in laparoscopic surgery and open surgery [5, 6]. The mechanism of ultrasonic knife cutting and solidification is to convert ultrasonic waves into high-frequency mechanical energy, and the heat provides cutting and solidification while minimizing thermal damage and reducing potential damage to adjacent tissue structures [7]. The ultrasound knife can coagulate 3-5 mm diameter blood vessels safely [8], which is consistent with the 3 mm diameter of the vas deferens, while the normal diameter of spermatic vessels is less than 2 mm. This coagulation ensures that the blood vessels are effectively closed. Because these devices are driven by ultrasound, not electrical energy, there is no current passing through the patient. The application of the ultrasonic knife in testicular excision is a new technology, its advantages are: (1) simple operation, simple cutting and coagulation can be completed to remove the testicle, replacing the traditional surgery on vas deferens blood vessels, the nerve is carefully peeled away in a tedious process; (2) Keeps the surgical field clear at all times; (3) the greatest advantage of the new surgical style is that there is no need to tie the sling with stitches, avoiding the occurrence of foreign object rejection reaction to the stitches, and the scrotum stubborn pain caused by the ligation of the sequestered nerve; (4) the incidence of postoperative complications from the new surgery is low, none of our

TABLE 1. Comparison of surgical parameters between the two groups ($\bar{x} \pm s$)

Group	The Number of Cases	Operative Time (min)	Intraoperative Blood Loss (mL)	Postoperative Hospital Stay (d)
Traditional operation group	27	25.63 ± 4.78	4.52 ± 2.39	3.55 ± 0.91
Ultrasonic scalpel operation group	42	17.31 ± 4.92	2.15 ± 1.16	3.33 ± 1.17
T value		6.93	5.51	0.83
P value		< 0.01	< 0.01	0.41

42 cases showed complications after surgery. Bapat [9] *et al.* compared bilateral subscapular orchiectomy and bilateral total orchiectomy in patients with metastatic prostate cancer. They observed similar castration levels of testosterone in both groups after surgery. There was no significant difference in postoperative complication rate and operation time. Bilateral subscapular orchiectomy was associated with better outcomes in terms of aesthetic appearance and patient satisfaction compared to bilateral total orchiectomy [10]. This seems to suggest that the use of ultrasound scalpel for bilateral subscapular orchiectomy is also feasible and may have similar advantages. At present, with the continuous development of medical technology, medical devices tend to be more user-friendly in price. Importantly, it is convenient and safe to perform surgery with the ultrasonic scalpel, including orchiectomy.

In summary, our current research shows that testicular excision with an ultrasonic knife is workable, safe, more convenient and effective than traditional surgical methods, and that the learning curve is short and worth studying on a larger scale.

Author contributions

YL and DQL wrote the article, HMH did the video editing and production, and XHZ and XHW did the modification and final review of the article. All authors read and approved the final manuscript.

Ethics approval and consent to participate

All subjects signed their informed consent form for inclusion prior to participating in the study. The study was conducted in accordance with the WMA's Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Zhongnan Hospital of Wuhan University.

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Conflict of interest

The authors declare no conflict of interest.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at https://oss.jomh.org/jomh/article/1354679745516584960/attachment/353-20201120.mp4.

References

[1] Srivatsav A, Balasubramanian A, Butaney M, Thirumavalavan N, McBride JA, Gondokusumo J, *et al.* Patient attitudes toward testicular prosthesis placement after orchiectomy. American Journal of Men's Health. 2019; 13: 155798831986101.

[2] Dowling CM, Assel M, Musser JE, Meeks JJ, Sjoberg DD, Bosl G, *et al.* Clinical outcome of retroperitoneal lymph node dissection after chemotherapy in patients with pure embryonal carcinoma in the orchiectomy specimen. Urology. 2018; 114: 133-138.

[3] Paffenholz P, Pfister D, Heidenreich A. Postchemotherapy residual tumour resection in complex metastatic sites of advanced testicular germ cell tumours. Urologe-Ausgabe A. 2016; 55: 632-640.

[4] Hicks N, Gupta S. Complications and risk factors in elective benign scrotal surgery. Scandinavian Journal of Urology. 2016; 50: 468-471.

[5] Jiang J, Shen M, Lu H. Ultrasonic scalpel with knot tying protects parathyroid function for total thyroidectomy with central neck dissection. Gland Surgery. 2020; 9: 192-199.

[6] Morino M, Rimonda R, Allaix ME, Giraudo G, Garrone C. Ultrasonic versus standard electric dissection in laparoscopic colorectal surgery: a prospective randomized clinical trial. Annals of Surgery. 2005; 242: 897-901.

[7] Salami A, Dellepiane M, Bavazzano M, Crippa B, Mora F, Mora R. New trends in head and neck surgery: a prospective evaluation of the Harmonic Scalpel. Medical Science Monitor. 2008; 14: PI1-PI5.

[8] Caronia FP, Arrigo E, Trovato S, Lo Monte AI, Cottone S, Sgalambro F, *et al.* Uniportal bilateral video-assisted sequential thoracoscopic extended thymectomy. Journal of Visualized Surgery. 2017; 3: 69.

[9] Bapat S, Mahajan PM, Bhave AA, Kshirsagar YB, Sovani YB, Mulay A. Prospective randomised controlled trial comparing sub-epididymal orchiectomy versus conventional orchiectomy in metastatic carcinoma of prostate. The Indian Journal of Surgery. 2011; 73: 175-177.

[10] Selvi I, Basar H. Subcapsular orchiectomy versus total orchiectomy and LHRH analogue in the treatment of hormone-sensitive metastatic prostate cancer: a different perspective in evaluation of the psychosocial effects. Supportive Care in Cancer. 2020; 28: 4313-4326.