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Recent Trends in Transurethral Surgeries and Urological Outpatient Procedures: a Nationwide Population-based Cohort Study

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ABSTRACT

Background: Demographic change and advances in technology affect transurethral surgery and outpatient procedures in the urologic field. There are few population-based studies that accurately assess the trend of transurethral surgery and outpatient procedures including diagnostic tests. We investigated the recent epidemiologic trends in transurethral surgeries and urological outpatient procedures from 2009 to 2016 in Korea using the entire population-based cohort.
Methods: We analyzed medical service claim data of transurethral surgery, urological outpatient procedures submitted by medical service providers from the Health Insurance Review and Assessment Service from 2009 to 2016.
Results: Transurethral ureter surgery increased by 134.9% from 14,635 in 2009 to 34,382 in 2016 (B = 2,698; $R^2 = 0.98$; $P < 0.001$). The transurethral bladder surgery increased by 65.5% from 12,482 in 2009 to 20,658 in 2016 (B = 1,149; $R^2 = 0.97$; $P < 0.001$). Over the 8-years period, there were not significant changes in transurethral prostate (B = 43; $R^2 = 0.04$; $P = 0.617$) and urethral surgery (B = –12; $R^2 = 0.18$; $P = 0.289$). The significantly increasing trends in cystoscopy (B = 5,260; $R^2 = 0.95$; $P < 0.001$) and uroflowmetry (B = 53,942; $R^2 = 0.99$; $P < 0.001$) were observed during the 8-year period. There was no difference in bladder catheterization during the 8-year period. Urodynamic study (UDS: B = –2,156; $R^2 = 0.77$; $P = 0.003$) and electrical stimulation treatment (EST: B = –1,034; $R^2 = 0.87$; $P < 0.001$) significantly decreased.
Conclusion: In Korea, transurethral ureter surgery and transurethral bladder surgery have been continuously increasing. Transurethral prostate surgery and transurethral urethral surgery remained constant with no increase or decrease. Cystoscopy and uroflowmetry continue to increase, while UDS and EST continue to decrease.

Keywords: Lower Urinary Tract Symptoms; Urologic Surgical Procedure; Diagnostic Techniques and Procedures; Insurance; Health

INTRODUCTION

The urinary system discharges waste products from the body in the form of urine through the kidney, ureter, bladder, and urethra. Transurethral surgery using the opposite route of the urine drainage is a specialized area of urology and a typical minimal invasive surgery

Disclosure

The authors have no potential conflicts of interest to disclose.

Author Contribution

Conceptualization: Han JH, Lee YG. Data curation: Han JH, Kim JK, Lee YG, Choi CI, Kim US, Kwon HS. Formal analysis: Han JH, Lee SH, Kim JK, Choi CI. Funding acquisition: Han JH, Kim JK. Investigation: Han JH, Kim JK. Methodology: Han JH, Kim JK. Project administration: Han JH, Kim JK, Kim US, Kwon HS. Resources: Han JH, Kim JK. Supervision: Han JH. Validation: Kim JK, Lee SH. Visualization: Kim JK, Lee SH. Writing - original draft: Han JH, Kim JK. Writing - review & editing: Han JH, Kim JK, Kim US, Kwon HS.

using natural orifice. Transurethral surgery can be categorized into four types depending on the type of target organ: transurethral ureteral surgery, transurethral bladder surgery, transurethral prostate surgery, and transurethral urethral surgery. Transurethral surgery has been steadily changing with the advance of technology and instruments. In particular, advances in optical technology and working elements have provided better feasibility to the operator. In the studies using big data in the United States and Australia, changes in transurethral surgery for prostatic hyperplasia have been observed.[1,2] We recently reported a rapid change in the recent 8 years of ureteroscopic surgery for symptomatic urolithiasis.[3] Transurethral surgery is a popular surgical method for urologists, and it is easily performed in hospital and clinic.[4] However, most recent reports of changes in the transurethral surgery have been limited to the prostate surgery. There is a lack of reports on transurethral surgery by other surgical sites. At the urological outpatient site, various tests and procedures are performed for the diagnosis and treatment for patients. Demographic change and advances in technology and equipment also affect urological outpatient examinations and procedures. Cystoscopy and uroflowmetry are important examination tools in urological outpatient clinics. However, there are few population-based studies that accurately assess the trend of the frequency of diagnostic tests and procedures applied directly to urologic outpatients. We examined the recent epidemiologic trends in transurethral surgeries and urological outpatient procedures from 2009 to 2016 in Korea using the entire population-based cohort.

METHODS

Data collection

This study is a cross-sectional epidemiological study in a Korean population using the Health Insurance Review and Assessment Service (HIRA) database from 2009 to 2016. We showed medical service claim data of transurethral surgical treatments and urological outpatient procedures for outpatients submitted by medical service providers during the same period. The HIRA monitors and analyzes reimbursement records from the Korean National Health Insurance and Korean Medical Aid. Because almost all Koreans are required to join the National Health Insurance (approximately 96.3% of the population) or the Korean Medical Aid (approximately 3.7%), the HIRA records cover almost all Korean citizens (approximately 50 million people).[5] The HIRA database contains not only an individual beneficiary's information but also healthcare service information, such as diagnosis, procedures, prescriptions, and tests. All clinics and hospitals submit claims data for inpatient and outpatient care, including diagnoses, procedures, prescription records, demographic information, and direct medical costs, to HIRA to obtain reimbursement of medical costs from the government. The HIRA database was established based on the Korean Standard Classification of Diseases-6th revision (KCD-6), which is a modified version of the International Statistical Classification of Diseases and Related Health Problems 10th revision for the Korean healthcare system. We categorized transurethral surgery into four types depending on the type of target organ: transurethral ureteral surgery, transurethral bladder surgery, transurethral prostate surgery, and transurethral urethral surgery. Transurethral ureteral surgery included ureteroscopic lithotripsy (R3216–18), flexible ureterorenoscopic lithotripsy (R3424–27), ureteral stent insertion (R3261–2), transurethral ureteral dilation (R3191, R3194–5, R3197) and transurethral resection of ureterocele (R3200). Transurethral bladder surgery included transurethral removal of bladder stone or foreign body (R3511), transurethral resection of bladder tumor (TUR-BT; R3512), and transurethral bladder surgery (ureteral orifice incision, R3514; fulguration, R3515; bladder neck incision, R3530;

hematoma removal, R3540). Transurethral prostate surgery included transurethral resection of the prostate (TUR-P; R3975), photo-selective vaporization of the prostate (PVP; R3976), holmium laser enucleation of the prostate (HoLEP; R3977), and thermal therapy of the prostate (R3516). Transurethral urethral surgery included transurethral sphincterotomy (R3520), transurethral urethral stent insertion (R3663), transurethral urethral realignment (R3664) transurethral urethrotomy (R3665), and transurethral removal of urethral stone or foreign body (R3671, R3673). Urological outpatient procedures included cystoscopy (E7730, E7750), uroflowmetry (EY521–2), prostate massage (R3980), prostate biopsy (C8551), intra-prostatic injection (KX001), urethral dilation (R3641), urethral catheterization (M0050), indwelling of Foley catheter (M0060), suprapubic cystostomy (R3576), change of cystostomy (R3577), bladder irrigation (R3490), urodynamic study (UDS; E6563–4) and electrical stimulation treatment for incontinence (EST; MX034).

Statistical analysis

Linear regression analyses were carried out using IBM SPSS Statistics 24.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel 2010 (Microsoft, Redmond, WA, USA). The Durbin–Watson method was used to evaluate the independence of residuals. All tests were two-sided with a statistical significance set a $P < 0.05$.

Ethics statement

The present study was carried out in accordance with good clinical practice guidelines and the Declaration of Helsinki. We analyzed data in a form that the data were completely anonymized and could not identify information about the patients. For this reason, the Institutional Review Board of Hallym University Dongtan Sacred Heart Hospital decided to exempt from this study (HRT 2017-07-003).

RESULTS

Transurethral surgery from 2009 to 2016

Transurethral ureter surgery increased by 134.9% from 14,635 in 2009 to 34,382 in 2016 (B = 2,698; $R^2 = 0.98$; $P < 0.001$). The transurethral bladder surgery increased by 65.5% from 12,482 in 2009 to 20,658 in 2016 (B = 1,149; R^2=0.97; $P < 0.001$). Over the 8-years period, there were not significant changes in transurethral prostate (B = 43; $R^2 = 0.04$; $P = 0.617$) and urethral surgery (B = –12; $R^2 = 0.18$; $P = 0.289$) (**Fig. 1**). Looking at the details of transurethral ureter surgery, the increase in ureteral stent insertion (B = 1,225; $R^2 = 0.97$; $P < 0.001$) and ureteroscopic lithotripsy (B = 870; $R^2 = 0.99$; $P < 0.001$) was remarkable, and the increase in flexible ureterorenoscopic lithotripsy had been observed since 2015 (B = 425; $R^2 = 0.76$; $P = 0.005$) (**Fig. 2**). The number of claims continued to increase in all transurethral bladder surgeries, with TUR-BT increasing most rapidly over the 8-year period (B = 713; $R^2 = 0.98$; $P < 0.001$) (**Fig. 3**).

The number of transurethral prostate surgeries was no significant change (**Fig. 1**), but there was a significant decrease in thermal therapy (B = –185; $R^2 = 0.89$; $P < 0.001$), and open prostatectomy (B = –31; $R^2 = 0.91$; $P < 0.001$) during the 8-year period. TUR-P was the most commonly performed surgery for transurethral prostate surgery, but there was no significant change during the 8-year period (B = –42; $R^2 = 0.13$; $P = 0.384$). The number of PVP showed a significant decrease from 3,991 in 2009 to 723 in 2016 (B = –456; $R^2 = 0.97$; $P < 0.001$). On the other hand, the number of HoLEP increased sharply and it had been conducted more than

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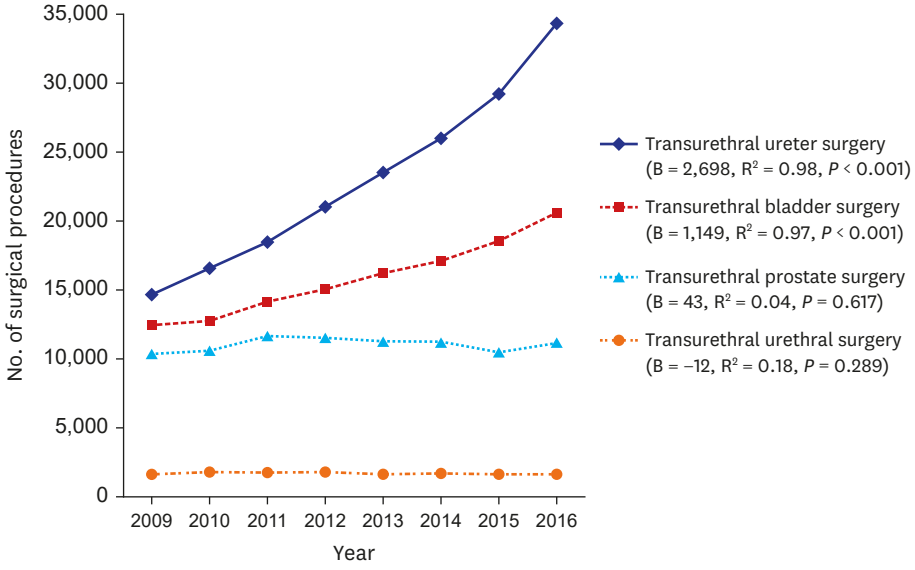

Fig. 1. Transurethral surgery from 2009 to 2016 in a Korean population. Transurethral ureter surgery increased by 134.9% from 14,635 in 2009 to 34,382 in 2016 (B = 2,698; R^2 = 0.98; P < 0.001). The transurethral bladder surgery increased by 65.5% from 12,482 in 2009 to 20,658 in 2016 (B = 1,149; R^2 = 0.97; P < 0.001). Over the 8-year period, there were not significant changes in transurethral prostate (B = 43; R^2 = 0.04; P = 0.617) and urethral surgery (B = −12; R^2 = 0.18; P = 0.289).

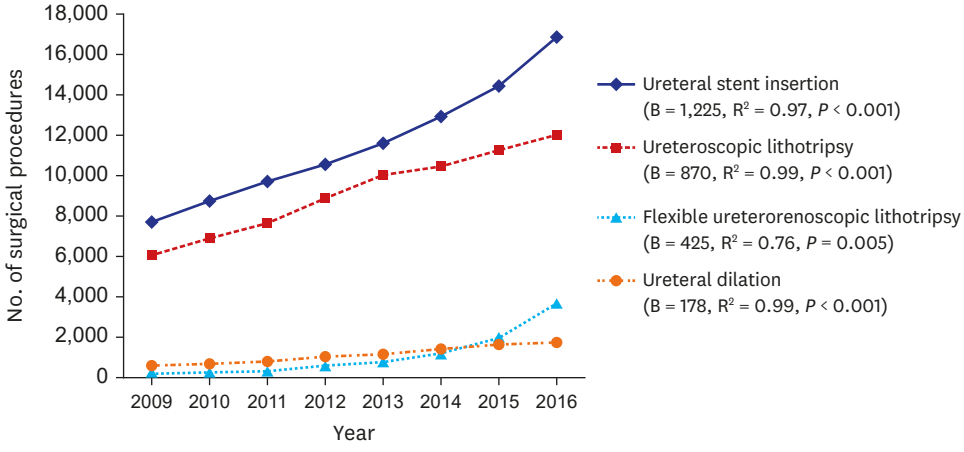

Fig. 2. Transurethral ureter surgery from 2009 to 2016 in a Korean population. The increase in ureteral stent insertion (B = 1,225; R^2 = 0.97; P < 0.001) and ureteroscopic lithotripsy (B = 870; R^2 = 0.99; P < 0.001) was remarkable, and the increase in flexible ureterorenoscopic lithotripsy had been observed since 2015 (B = 425; R^2 = 0.76; P = 0.005).

PVP after 2012 (B = 540; R^2 = 0.90; P < 0.001) (**Fig. 4**). The number of transurethral urethra surgeries showed little change (**Fig. 1**), but there was a significant increase in transurethral urethral realignment over the 8-year period (B = 8.250; R^2 = 0.826; P = 0.002).

Urological outpatient procedures from 2009 to 2016

In 2009 and 2016, when comparing the number of urological procedures conducted, the main diagnostic tools, cystoscopy (46.4%) and uroflowmetry (86.4%), showed an increase. The significantly increasing trends in cystoscopy (B = 5,260; R^2 = 0.95; P < 0.001), uroflowmetry (B = 53,942; R^2 = 0.99; P < 0.001), and urethral dilation (B = 394; R^2 = 0.82;

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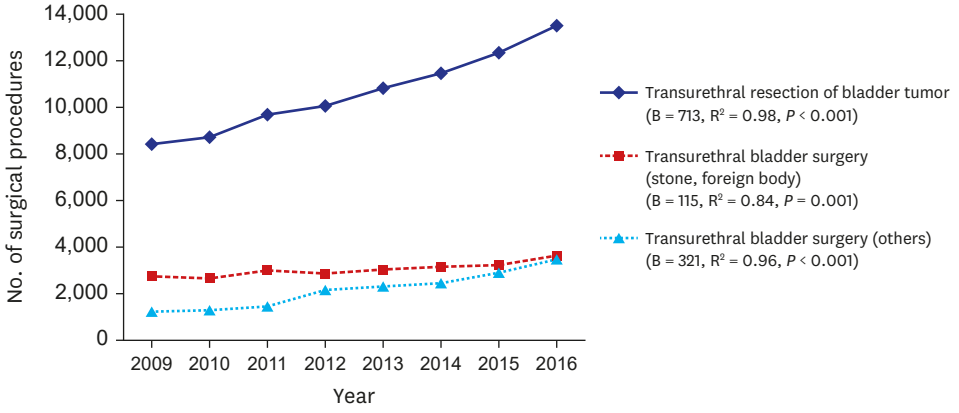

Fig. 3. Transurethral bladder surgery from 2009 to 2016 in a Korean population. The number of claims continued to increase in all transurethral bladder surgeries, with transurethral resection of bladder tumor increasing most rapidly over the 8-year period (B = 713; R^2 = 0.98; P < 0.001).

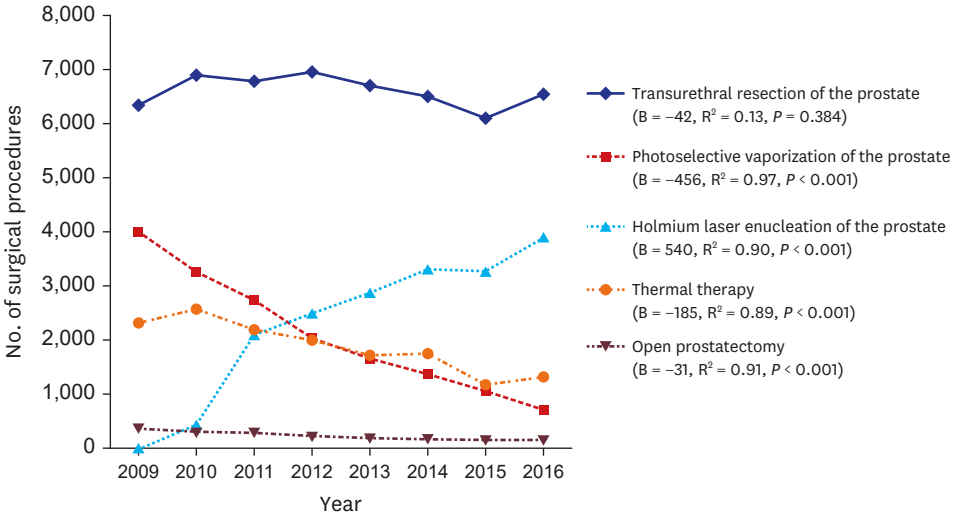

Fig. 4. Transurethral prostate surgery from 2009 to 2016 in a Korean population. There are significant decreases in thermal therapy (B = −185; R^2 = 0.89; P < 0.001), and open prostatectomy (B = −31; R^2 = 0.91; P < 0.001) during the 8-year period. Transurethral resection of the prostate was the most commonly performed surgery for transurethral prostate surgery, but there was no significant change during the 8-year period (B = −42; R^2 = 0.13; P = 0.384). The number of photoselective vaporization of the prostate showed a significant decrease from 3991 in 2009 to 723 in 2016 (B = −456; R^2 = 0.97; P < 0.001). On the other hand, the number of Holmium laser enucleation of the prostate increased, and it had been conducted more than photoselective vaporization of the prostate after 2012 (B = 540; R^2 = 0.90; P < 0.001).

P = 0.002) were observed during the 8-year period. However, prostate massage decreased significantly during the 8-year period (B = −18,716; R^2 = 0.94; P < 0.001) (**Table 1**). There was no difference in bladder catheterization during the 8-year period, but there was a significant

Table 1. Urological outpatient procedures from 2009 to 2016 in a Korean population

Variables	2009	2010	2011	2012	2013	2014	2015	2016	Slope (B)	R^2	P value
Cystoscopy	82,369	83,570	88,791	93,935	96,275	101,743	110,200	120,568	5,260	0.95	< 0.001
Uroflowmetry	434,045	494,674	552,970	619,704	661,249	722,705	765,984	808,881	53,942	0.99	< 0.001
Prostate massage	653,544	611,585	600,836	583,779	567,145	563,111	540,084	498,574	−18,716	0.94	< 0.001
Prostate biopsy	18,339	19,282	21,437	22,292	21,817	21,114	20,857	24,127	559	0.60	0.026
Intraprostatic injection	2,587	3,580	3,551	4,394	4,030	5,232	4,861	4,149	262	0.60	0.024
Urethral dilation	11,149	10,814	10,999	11,044	11,547	12,290	13,077	13,638	394	0.82	0.002

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Table 2. Urinary bladder catheterization related procedure from 2009 to 2016 in a Korean population

Variables	2009	2010	2011	2012	2013	2014	2015	2016	Slope (B)	R^2	*P* value
Nelaton catheterization	829,283	862,108	873,353	878,407	891,573	868,207	867,945	863,969	3,211	0.20	0.275
Foley catheter indwelling	1,164,721	1,233,022	1,258,919	1,200,791	1,273,627	1,178,608	1,215,559	1,233,866	2,722	0.03	0.675
Suprapubic cystostomy	2,365	2,452	2,478	2,441	2,404	2,365	2,326	2,207	−25	0.51	0.048
Cystostomy change	22,346	23,753	25,925	27,553	30,839	32,884	33,221	33,373	1,771	0.94	< 0.001
Bladder irrigation	279,891	276,090	272,330	277,778	280,848	308,588	317,724	314,889	6,726	0.74	0.006

Table 3. Urodynamic study and electrical stimulation from 2009 to 2016 in a Korean population

Variables	2009	2010	2011	2012	2013	2014	2015	2016	Slope (B)	R^2	*P* value
Urodynamic study	68,242	58,161	56,567	55,073	53,138	53,079	51,974	48,557	−2,156	0.78	0.003
Urology	24,388	22,001	22,383	21,359	20,397	20,302	20,394	20,041	−544	0.78	0.002
Gynecology	37,807	30,786	29,058	25,969	25,219	24,728	23,719	21,755	−1,922	0.83	0.001
Neurology	369	338	329	317	424	341	310	287	−23	0.24	0.220
Rehabilitation medicine	796	865	941	949	977	1,092	1,218	1,218	62	0.94	< 0.001
Others	4,882	4,170	3,856	6,480	6,122	6,616	6,333	5,256	254	0.33	0.135
Electrical stimulation	11,006	8,913	7,414	5,351	4,520	4,446	4,069	3,453	−1,034	0.87	< 0.001
Urology	1,964	2,020	2,101	1,432	985	640	896	172	−274	0.88	0.001
Gynecology	7,838	5,822	4,845	3,764	3,353	3,700	3,129	3,261	−588	0.73	0.004
Others	1,203	1,071	468	156	182	106	44	20	−172	0.80	0.003

increase in cystostomy change (B = 1,771; R^2 = 0.94; P < 0.001), and bladder irrigation (B = 6,726; R^2 = 0.74; P = 0.006) (**Table 2**).

A total of 444,791 UDS were conducted from 2009 to 2016, and the number of UDS decreased by 28.8% over the 8-year period. The total number of UDS showed a significant decrease over the 8-year period (B = −2,156; R^2 = 0.78; P = 0.003), but the number of UDS in rehabilitation medicine increased slightly (B = 62; R^2 = 0.94; P < 0.001). The ratio of urology and other departments to UDS was 38.5% vs. 61.5% over the 8-year period. The total number of EST also showed a significant decrease over the 8-year period (B = −1,034; R^2 = 0.87; P < 0.001). The ratio of urology and other departments to EST was 20.8% vs. 79.2% over the 8-year period (**Table 3**).

DISCUSSION

In Korea, 23.2% of male adults over 50 years suffered from moderate to severe lower urinary symptoms, with the incidence increasing with age.[6] Urinary incontinence is common in the elderly and increases with age. The prevalence of urinary incontinence in medical welfare facilities in Korea was about 65.3%.[7] With the increase in the elderly population and the prevalence of LUTS, the demand for diagnostic tools has increased and treatment options are also changing. In addition, medical costs associated with the diagnosis and treatment of urologic diseases continue to increase with the aging of the global population.[8] In this study, we analyzed recent changes over the last 8 years in diagnostic tools and treatment options in patients who underwent urologic diseases. Transurethral endoscopic surgery is a relatively less invasive surgical procedure that can be performed on the urinary tract. In this study, we confirmed that transurethral ureter surgery and transurethral bladder surgery were significantly increased. Ureteroscopic lithotripsy and flexible ureterorenoscopic lithotripsy showed a significant increase during the 8-year period. In particular, flexible ureterorenoscopic lithotripsy has increased rapidly in recent years thanks to improvements in endoscopic performance and advance of therapeutic materials such as access sheath. Extracorporeal shockwave lithotripsy (ESWL) is the most preferred treatment by urologists

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for urolithiasis. In the previous study, the use of ESWL for treating urolithiasis increased by 16% from 89,553 in 2009 to 104,013 in 2016 (B = 2,284; R^2 = 0.684; P = 0.011).[3] In recent, many urologists have chosen flexible ureterorenoscopic surgery to completely remove complex renal stones, and actively switching to ureteroscopic surgery for stones with delayed discharge even after ESWL. This is presumed to be because most urologists claim ureteral stent insertion when switching to ureteroscopic surgery due to delayed discharge of stones and severe pain after ESWL. In the United States, incidence rates of bladder cancer increased by 0.16% per year for the last four decades and incidence-based mortality decreased since 2000.[9] In particular, the age-adjusted incidence rate and 5-year survival rates for a localized stage of bladder cancer increased from 1973 to 2009.[10] In Korea, the number of bladder cancer cases increased from 2,180 cases in 1999 to 3,549 cases in 2011.[11] The increment of bladder cancer incidence rate might contribute to the increase in TUR-BT. Moreover, as our study shows, the increment of cystoscopy seems to help with early detection of initial and recurrent bladder cancer. These could contribute to the steady increase of TUR-BT. Patients with prostatic hyperplasia usually start with medical treatment and optionally undergo surgical treatment.[5] In this study, there were not significant changes in transurethral prostate surgery over the 8-years period. Conventional TUR-P is still recognized as a gold standard surgical treatment in prostatic hyperplasia, and it is steadily implemented because most medical institutions have basic TUR equipment. HoLEP has more benefits such as the increased amount of tissue removal, shorter catheterization time, shorter hospital length of stay, and lower transfusion rates than other transurethral prostate surgeries.[4,12] Recently, HoLEP showed comparable or superior surgical outcomes than TUR-P, and many urologists prefer HoLEP due to fewer postoperative complications.[4] Our data show that HoLEP is rapidly replacing PVP.

With the increase in the elderly population, uroflowmetry, which is used for diagnosis and monitoring of voiding diseases, continues to increase. Uroflowmetry is easy to perform and can be analyzed quickly, and its installation costs are relatively low, making it widely used in the outpatient field. Also, cystoscopy is an effective diagnostic tool that can be easily performed in the outpatient field and is widely used in the diagnosis of hematuria, bladder tumors, and persistent voiding disorders.[13] In our study, it was confirmed that uroflowmetry and cystoscopy increased continuously during the investigation period, but prostate massage continues to decline significantly. Prostate massage is an outpatient procedure used to diagnose and treat chronic prostatitis. The previous survey reported that many urologists do not routinely subject their patients to the diagnostic procedures required to differentiate among the various manifestations of chronic prostatitis syndrome.[14] In Korea, less than half of urologists employ culture tests in the diagnosis of chronic prostatitis, and most urologists prescribe antibiotic treatment as a treatment of chronic prostatitis according to personal beliefs and professional characteristics of individual physicians.[15] Prostate massage, which has been widely practiced in the past, seems to decrease continuously due to clinician preference for diagnosis and treatment. Nelaton catheterization, Foley catheter indwelling, and suprapubic cystostomy have been maintained steadily during the investigation period, and cystostomy change and bladder irrigation have been cumulative and increased during the investigation period.

A study of UDS patterns in the United States from 2002 to 2007 showed that stress incontinence was the most common clinical condition, urologists performed 59.8%, and gynecologists performed 35.5%.[16] In Korea, UDS is obligatory before anti-incontinence surgery. Anti-incontinence surgery in Korea was significantly reduced to 60,520 cases in 2006 and 24,599 cases in 2015.[17] In this study, UDS has been continuously decreasing during

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the investigation period. The reduction in gynecology was found to be greater than that of urology. Our results showed a steady decline in EST during the study period. Previous studies revealed a large variation in the effect of EST for urinary incontinence and discontinuation rate is relatively high.[18-20]

It will remain unchanged that ESWL is the first treatment option in urolithiasis treatment. However, for rapid relief of stone pain and complete elimination of complex stones, transurethral ureter surgery is expected to continue to increase and develop. Also, with an increase in the elderly population, transurethral prostate surgery and urological outpatient procedures are presumed to continue to increase.

There are some limitations to this study. First, it was a population-based analysis using an established cohort of NHIS based on medical insurance claims data. Thus, it has limitations in reflecting the actual situation in the field. Second, we could not adjust the number of performing tests and treatments per year by age. Our HIRA data lacks some important clinical data and individualized data. Despite these limitations, we believe that providing the actual number of claims provided by the health care provider has helped to identify the current trends in common urologic diagnostic tools and transurethral surgeries.

In conclusion, transurethral ureter surgery and transurethral bladder surgery have been continuously increasing in Korea. Transurethral prostate surgery and transurethral urethral surgery remained constant with no increase or decrease. Cystoscopy and uroflowmetry continue to increase, while UDS and EST continue to decrease.

REFERENCES

1. Patel RM, Bariol S. National trends in surgical therapy for benign prostatic hyperplasia in Australia. *ANZ J Surg* 2019;89(4):345-9.
PUBMED | CROSSREF
2. Welliver C, Feinstein L, Ward JB, Fwu CW, Kirkali Z, Bavendam T, et al. Trends in lower urinary tract symptoms associated with benign prostatic hyperplasia, 2004 to 2013: the Urologic Diseases in America Project. *J Urol* 2020;203(1):171-8.
PUBMED | CROSSREF
3. Kim JK, Cho YS, Park SY, Joo KJ, Min SK, Lee YG, et al. Recent surgical treatments for urinary stone disease in a Korean population: national population-based study. *Int J Urol* 2019;26(5):558-64.
PUBMED | CROSSREF
4. Jeon BJ, Chung H, Bae JH, Jung H, Lee JG, Choi H. Analysis of present status for surgery of benign prostatic hyperplasia in Korea using nationwide healthcare system data. *Int Neurourol J* 2019;23(1):22-9.
PUBMED | CROSSREF
5. Park J, Lee YJ, Lee JW, Yoo TK, Chung JI, Yun SJ, et al. Comparative analysis of benign prostatic hyperplasia management by urologists and nonurologists: a Korean nationwide health insurance database study. *Korean J Urol* 2015;56(3):233-9.
PUBMED | CROSSREF
6. Lee E, Yoo KY, Kim Y, Shin Y, Lee C. Prevalence of lower urinary tract symptoms in Korean men in a community-based study. *Eur Urol* 1998;33(1):17-21.
PUBMED | CROSSREF
7. Lee SH, Kang JS, Kim JW, Lee SJ. Incontinence pad usage in medical welfare facilities in Korea. *Int Neurourol J* 2013;17(4):186-90.
PUBMED | CROSSREF
8. McDonnell J, Busschbach JJ, Kok E, van Exel J, Stolk E, Koopmanschap M, et al. Lower urinary tract symptoms suggestive of benign prostatic obstruction--Triumph: health-economical analysis. *Eur Urol* 2001;39 Suppl 3:37-41.
PUBMED | CROSSREF

9. Al-Husseini MJ, Kunbaz A, Saad AM, Santos JV, Salahia S, Iqbal M, et al. Trends in the incidence and mortality of transitional cell carcinoma of the bladder for the last four decades in the USA: a SEER-based analysis. *BMC Cancer* 2019;19(1):46.
PUBMED | CROSSREF
10. Abdollah F, Gandaglia G, Thuret R, Schmitges J, Tian Z, Jeldres C, et al. Incidence, survival and mortality rates of stage-specific bladder cancer in United States: a trend analysis. *Cancer Epidemiol* 2013;37(3):219-25.
PUBMED | CROSSREF
11. Song W, Jeon HG. Incidence of kidney, bladder, and prostate cancers in Korea: an update. *Korean J Urol* 2015;56(6):422-8.
PUBMED | CROSSREF
12. Gilling PJ, Wilson LC, King CJ, Westenberg AM, Frampton CM, Fraundorfer MR. Long-term results of a randomized trial comparing holmium laser enucleation of the prostate and transurethral resection of the prostate: results at 7 years. *BJU Int* 2012;109(3):408-11.
PUBMED | CROSSREF
13. Gratzke C, Bachmann A, Descazeaud A, Drake MJ, Madersbacher S, Mamoulakis C, et al. EAU Guidelines on the assessment of non-neurogenic male lower urinary tract symptoms including benign prostatic obstruction. *Eur Urol* 2015;67(6):1099-109.
PUBMED | CROSSREF
14. de la Rosette JJ, Hubregtse MR, Karthaus HF, Debruyne FM. Results of a questionnaire among Dutch urologists and general practitioners concerning diagnostics and treatment of patients with prostatitis syndromes. *Eur Urol* 1992;22(1):14-9.
PUBMED | CROSSREF
15. Ku JH, Paick JS, Kim SW. Factors influencing practices for chronic prostatitis: a nationwide survey of urologists in South Korea. *Int J Urol* 2005;12(11):976-83.
PUBMED | CROSSREF
16. Reynolds WS, Dmochowski RR, Lai J, Saigal C, Penson DF; Urologic Diseases in America Project. Patterns and predictors of urodynamics use in the United States. *J Urol* 2013;189(5):1791-6.
PUBMED | CROSSREF
17. Choi JB, Han KD, Ha US, Hong SH. Efficacy and safety of incontinence surgery according to the surgeon's specialty and performance of a preoperative urodynamic study. *Int Neurourol J* 2018;22(4):305-12.
PUBMED | CROSSREF
18. Ohlsson BL. Effects of some different pulse parameters on the perception of intravaginal and intra-anal electrical stimulation. *Med Biol Eng Comput* 1988;26(5):503-8.
PUBMED | CROSSREF
19. Schreiner L, Santos TG, Souza AB, Nygaard CC, Silva Filho IG. Electrical stimulation for urinary incontinence in women: a systematic review. *Int Braz J Urol* 2013;39(4):454-64.
PUBMED | CROSSREF
20. Stewart F, Berghmans B, Bø K, Glazener CM. Electrical stimulation with non-implanted devices for stress urinary incontinence in women. *Cochrane Database Syst Rev* 2017;12:CD012390.
PUBMED | CROSSREF