JOURNAL OF
Endoluminal Endourology

Original Article
DOI: 10.22374/jeleuv1i1.5

COST ANALYSIS AND SERVICE DELIVERY ON USING ISIRIS α™ TO REMOVE URETERIC STENTS

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Submitted: March 9, 2017. Accepted: March 11, 2018. Published: April 16, 2018.

ABSTRACT

Isiris α™ (Coloplast®) is an innovative single-use disposable flexible cystoscope with an integrated ureteric stent grasper designed specifically to remove ureteric stents. It allows clinicians to remove ureteric stents easily on the wards or in clinics without the need of arranging a routine and dedicated flexible cystoscopy appointment for patients. We evaluated Isiris α's practical use and cost analysis against traditional reusable endoscopes.

Method

We compared the cost of removing ureteric stents using Isiris α™ in 10 patients prospectively versus traditional flexible cystoscopes in 10 patients retrospectively. The costs of the equipment, medications, reprocess machines, and utility costs were consulted from the relevant departments and companies. As for labour cost, we have sourced British Medical Association (BMA) and Royal College of Nursing (RCN) websites.

Results

From our study, it costs £260.65 and £123.41 on average to remove a ureteric stent using Isiris α™ and traditional flexible cystoscope respectively ($p<0.001$). Stent removal in the endoscopy department was delayed in 60% of patients, on average 6.4 days, compared to 0% of patients using Isiris α™ ($p = 0.048$).

Conclusion

Although Isiris α™ is shown to be a more expensive option to remove ureteric stents based on our analysis, it still provides clinicians flexibility and ease in removing ureteric stents in the outpatient clinic, reducing the pressure and demand for dedicated flexible cystoscopy slots in the endoscopy department.

A German surgeon named Dr. Gustav Simon described the first ever ureteric stent insertion during an open bladder surgery in 1800s.[1,2] Today, urologists are all very familiar ureteric stents as they are indispensable urological equipment. Ureteric stents are inserted for various reasons including relieving an infected and obstructed urinary system due to ureteric stones, managing ureteric trauma and pelvic ureteric junction obstruction, and identifying the ureters in complex pelvic surgeries.

Urological stone surgeons or endourologists may elect to insert a temporary ureteric stent after a long or difficult ureteroscopy and laser lithotripsy to prevent ureteric mucosal oedema, and residual stones from obstructing ureters. Traditionally, removing ureteric stents with a flexible cystoscope post ureteroscopies can be cumbersome and labour intensive. Moreover, traditional reusable scopes are often associated high maintenance costs, expensive sterilization process, and risks of transmission of diseases such as Creutzfeldt–Jakob

disease. To overcome these barriers, and to provide a simpler and more straightforward solution, Coloplast® (Humlebæk, Denmark) has developed Isiris α™ which is a single-use, disposable 16Ch flexible digital video flexible cystoscope with an integrated stent grasper (Figure 1). At the tip of the flexible cystoscope, there is a complementary metal–oxide–semiconductor (CMOS) sensor. The cystoscope can be easily connected a portable liquid crystal display (LCD) monitor which has an 8.5-inch display with a resolution of 800 by 600 pixels, allowing clinicians to remove ureteric stents in adults easily in clinics or on the wards. Isiris α™ was first introduced to urologists in the 32nd World Congress of Endourology (WCE) in London in Oct 2015.

The aim of our study is to evaluate the cost analysis and service delivery on using a classic digital flexible cystoscope versus Isiris α™ to remove a ureteric stent in a district general hospital in the UK. To our best knowledge, there is no such study in the literature.

METHODOLOGY

We compared the cost of removing ureteric stents using Isiris α™ in 10 patients prospectively versus 10 patients using traditional Olympus® (Tokyo, Japan) CYF-240 flexible cystoscopes retrospectively.

Costs, excluding staffing, were accrued from sources within the endoscopy, pharmacy and procurement departments within the hospital, and organizations which have provided the products to our department.

ENDOSCOPE

According to Olympus®, an Olympus® CYF-240 video flexible cystoscopes costs £18,156 and it is designed to have a shelf-life of 7 years. In our department, we have 6 Olympus® CYF-240 video flexible

FIG. 1 Isiris α™ (Permission for use granted by Coloplast®, Humlebæk, Denmark).

cystoscopes which have cost £108,936. The service package which our department has engaged with costs £5711.40 per scope per annum. The service package covers the cost of repairing these flexible cystoscopes and the provision of temporary loan cystoscopes. In 2017, we have performed 1262 flexible cystoscopies in total. The recommended retail price of an Isiris α™ quoted by Coloplast® is £250 each.

STACKS

Our department owns 2 Olympus® stacks which costs £13,500 each according to Olympus®. Similarly, they are designed to last about 7 years. The stacks in our department are not only designed to be used solely with flexible cystoscopes, but they are also designed to be used with bronchoscopes, colonoscopes and oesophago-gastro-duodenoscopes too. Each year, our department pays £5812.80 per stack for the service package. In 2017, our endoscopy department has performed 6410 endoscopic procedures. According to Coloplast®, the Isiris α's monitor costs £397 each and it is made to last for about 250 uses.

REPROCESSING HARDWARES

Our department paid £182,994 for 2 Getinge® (Gothenburg, Sweden) ED-Flow Automated Endoscope Reprocessors (AER), £53,100 for 3 Getinge® (Lancer) FD8e dryer and storage cabinets, £50,000 for 2 reverse osmosis machines from Triple Red® (Long Crendon, UK), and £56,000 to install the 2 reverse osmosis machines. These hardwares are also used by other endoscopes i.e. bronchoscopes, colonoscopes and oesophago-gastro-duodenoscopes in the department. To maintain these hardwares, our department subsequently paid £33,340.80, £20,336.40, and £24,000 per annum for the AERs, dryer and cabinets, and reverse osmosis machines respectively.

REPROCESSING PROCESS

For the reprocessing procedure and stent removal, all items were costed individually. For example, reprocessing fluid was calculated to the millilitre required per cycle and price worked out accordingly. The reprocessing cost per cycle is shown in Table 1.

TABLE 1 Breakdown Prices on the Cost of Each Reprocessing Cycle

Reprocessing Cost Per Cycle	Price
Perasitic Acid A	£1.87
Perasitic Acid B	£1.87
DLC Detergent	£0.37
2 Pairs of Sterile Gloves	£1.44
2 Aprons	£0.24
2 Oversleeves for Apron	£0.18
1 Inner Rubber Bung (Pierced Every Time by Stent Removal)	£3.30
Bag and Tag Liners	£1.13
Health Edge Book Page	£0.24
Health Edge First Label	£0.13
Patient Identifier Stickers	£0.17
Total	£10.94

Each flexible cystoscope spends 8 minutes of washing and 25 minutes of reprocessing in the AER before it is used again.

ENERGY AND WATER

Reverse osmosis is an energy intensive process. It requires high energy to drive water molecules against its concentration gradient through a permeable membrane. Based on Triple Red's calculation, using £1.42 per cubic metre of water and £0.0951 per kWh, each of our sterilization cycle will require £0.38 worth of electricity and water.

DISPOSABLES

The cost and breakdown of each disposable used for flexible cystoscopy and Isiris α™ is shown in Table 2. Under our hospital antimicrobial policy, we routinely give gentamicin 160 mg intramuscularly prior to ureteric stent removal.

TABLE 2 Cost and Breakdown of Each Disposable Item

	Cost	Number for Flexicystoscopy	Cost for Flexicystoscopy	Number for Isiris α™	Cost for Isiris α™
Cysto Pack	£0.90	1	£0.90	1	£0.90
Pair sterile gloves	£0.72	2	£1.44	1	£0.72
Optilube sterile lubricant	£1.16	1	£1.16	1	£1.16
Alcohol wipe	£0.05	1	£0.05	1	£0.05
5 mL syringe	£0.02	1	£0.02	1	£0.02
Blue needle	£0.02	1	£0.02	1	£0.02
1 litre normal saline	£0.70	1	£0.70	1	£0.70
Gentamicin 160 mg	£2.75	1	£2.75	1	£2.75
Giving set	£0.48	1	£0.48	1	£0.48
Adhesive aperture drape	£0.68	1	£0.68	1	£0.68
Disposable forceps	£20.00	1	£20.00	0	£0.00
Chlorhexidine	£0.15	1	£0.15	1	£0.15
			£28.35		£7.63

STAFFING

For nursing staff and healthcare assistants, an hourly rate taken from the Royal College of Nursing (RCN) pay scales was applied to give the cost per member of nursing staff. The median hourly rates for a Band 2 staff, a Band 3 staff and a Band 5 staff are quoted to be £8.46, £9.38, and £12.81 respectively. As consultants run the flexible cystoscopy lists, we have used the salary of a consultant from Threshold 4 on 2003 contract which is quoted to be £83,972 per annum on British Medical Association (BMA). Their salary is divided by 52 working weeks, working an average of 48 hours per week using European Working Time Directive restrictions. Routinely, we have a Band 2 and two Band 5 staff working alongside with a consultant in a flexible cystoscopy list, and 2 Band 3 staff working in the reprocessing area.

STATISTICAL ANALYSIS

An unpaired t-test was used for statistical analysis.

Results

In 2017, the endoscopy department has performed 6410 endoscopic procedures. Of which, there were 1262 flexible cystoscopies performed across 151 sessions in our unit. 25 ureteric stents were removed with a flexible cystoscope.

Based on our calculation, it costs £260.65 and £123.41 on average to remove a ureteric stent using Isiris α™ and traditional flexible cystoscope respectively ($p<0.001$).

Stent removal in the endoscopy department was delayed in 60% of patients, on average 6.4 days, compared to 0% of patients using Isiris α™. No harm was done on patients who faced a delay in having their ureteric stents removed. Ureteric stent removal using

TABLE 3 Differences between Resuable Endoscope and Single-Use, Disposable Endoscope

Reusable Endoscope	Single-Use, Disposable Endoscope
Multiple Uses	Single Use
Risk of Damage	No Risk of Damage
Wear and Tear	No Wear and Tear
Sterilization Cost	No Sterilization Cost
Not Convenient	Convenient
Not Sterile	Sterile

Isiris α™ allows more flexibility such as arranging removal in the outpatient clinic setting and this in turn may increase capacity for urgent endoscopic procedures.

Additionally, there was no infection noted in each arm of the study.

Discussion

In recent years, there has been growing interest and demand for single-use, disposable medical instruments and endoscopes. This is fuelled by the advantages that single-use, disposable medical instruments and endoscopes have over their reusable counterparts. The advantages include convenience, sterility, and guaranteed factory quality. Advantages of single-use, disposable endoscopes will be elaborated in the subsequent section of this paper (Table 3). However, the cost effectiveness of such single-use, disposable medical instrument and endoscopes remains controversial and debatable.[3–12]

NEW SCOPE EACH TIME

Just like any mechanical instruments, endoscopes are susceptible to wear and tear, more so those used for flexible cystoscopy as it is a delicate medical instrument. As previously mentioned, we have performed 1262 flexible cystoscopies using 6 flexible cystoscopes in 2017. During this period, the flexible cystoscopes were out of service on 18 occasions. This resulted in cancellations or reductions of several elective and urgent flexible cystoscopy lists, leading to unnecessary inconvenience, disappointment, dissatisfaction, and anxiety among patients.

Unsurprisingly, one of the oldest flexible cystoscopes that our department owns, the flexible cystoscope that was purchased in 2001, was out of service 4 times in 2017. This is the result of cumulative wear and tear over the years (Table 4).

An independent analysis of Olympus® fibreoptic flexible cystoscope repairs undertaken by Canales et al. showed that the most common damage on a flexible cystoscope is the outer bending rubber on distal deflection tip.[13] This is not unexpected as this part of the flexible cystoscope is constantly subjected to enormous amount of stress especially when it is deflected during cystoscopy. As for our flexible cystoscopes, leaks and cracked lens were the most common issues observed. A study by McGill et al. looked at the durability of flexible cystoscopes.[14] After implementing a more robust handling and maintenance of 4 flexible cystoscopes policy in their department, the mean failure rate has substantially improved from 134.6 procedures per failure to 495.4 procedures per failure. In our experience, we have 11.7 procedures per failure per scope on average in 2017. This is probably because most of our flexible cystoscopes are more than 10 years old.

With single-use, disposable endoscopes, clinicians do not to have to worry about repairs, service and maintenance of these delicate instruments. Every time a clinician uses a single-use, disposable endoscope, he/she is guaranteed that the endoscope is new and there is no previous wear and tear on it. There is less chance of it breaking down. Certainly, such single-use, disposable endoscopes are useful especially in less

TABLE 4 Reasons Why Our Flexible Cystoscopes Were Out of Service

Cystoscope	Year of Purchase	Month	Reason
Cystoscope 1	2001	Feb 2017	Service
		July 2017	Leak
		Nov 2017	Health Check
		Nov 2017	Leak
Cystoscope 2	2001	Jan 2017	Service
		Nov 2017	Health Check
		Nov 2017	Cracked Lens
Cystoscope 3	2006	Feb 2017	Broken port
		Nov 2017	Cracked Lens
		Nov 2017	Health Check
Cystoscope 4	2007	Jan 2017	Cracked Lens
		Nov 2017	Health Check
		Nov 2017	Connection Problem
Cystoscope 5	2007	Feb 2017	Leak
		Sept 2017	Leak
Cystoscope 6	2015	Feb 2017	Service
		March 2017	Leak
		Nov 2017	Health Check

developed countries or rural hospitals where access to prompt repairs and services of endoscopes is limited.

INFECTIONS

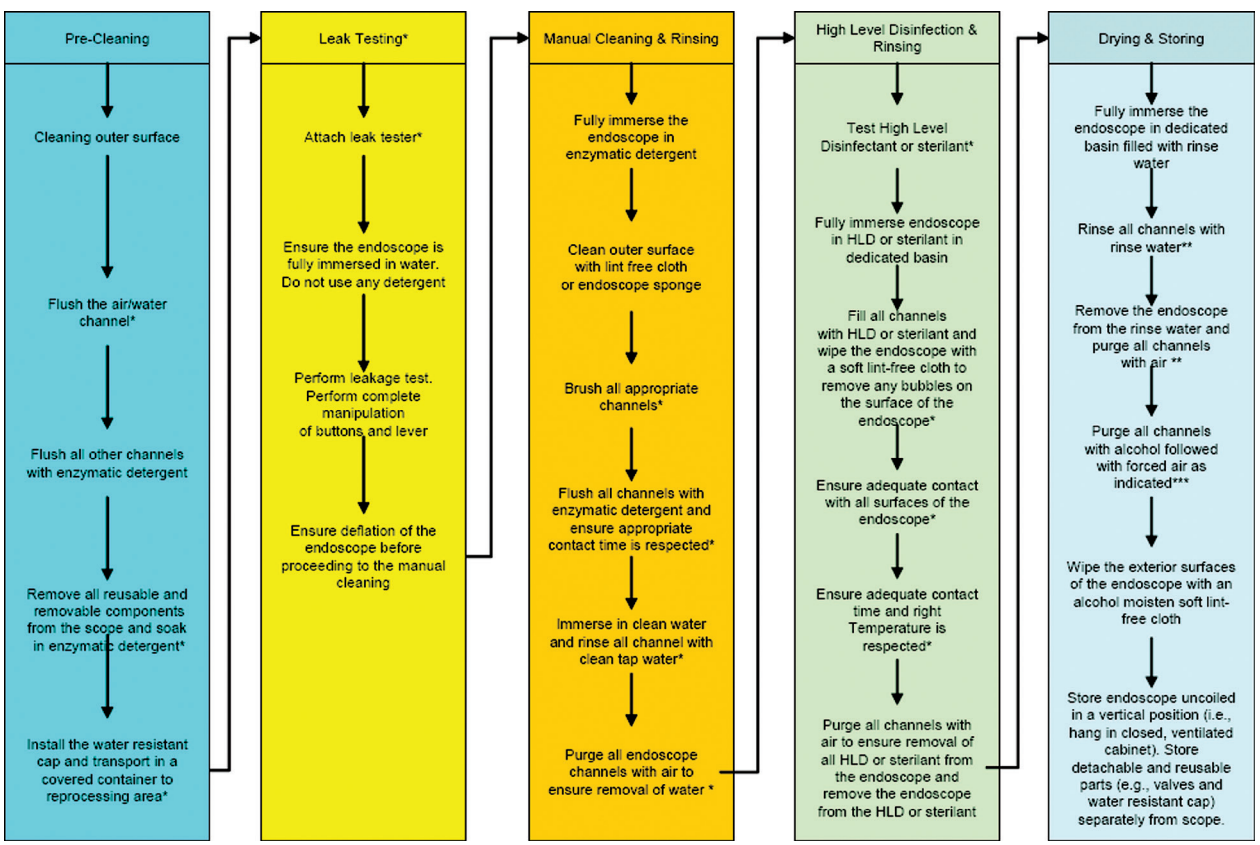
Dr. Earle Spaulding first described a classification system looking at how devices were used and what impact they had on transmitting infection in 1968.[15] Under the Spaulding classification, endoscopes such as cystoscopes and bronchoscopes are classified as "semicritical" medical devices which require high-level disinfection between patients. High-level disinfection is different from sterilization as high-level disinfection does not kill large numbers of bacterial spores while sterilization involves the complete destruction of all microbes. As endoscopes are temperature sensitive medical devices, low-temperature chemical methods are used to achieve high-level disinfection instead of steam sterilization.[16,17] Furthermore, endoscopes are inherently very highly complex mechanical instruments as they have complex pulley systems within and multiple working channels for various purposes. Needless to say, reprocessing of such instruments can be challenging. It is therefore, not surprising to learn that after reprocessing, the overall microbial-free

compliance rate is only about 81–86% which is certainly not ideal.[18,19] Last but not least, in its own right, reprocessing endoscopes is also a sophisticated, multiple-step procedure (Figure 2). Any error in each step could compromise the level of disinfection of endoscopes.

Given these circumstances, multiple cross contaminations have also been documented following cystoscopies, gastric endoscopies, duodenoscopies, and bronchoscopies.[20–25] Specifically in urology, there are at least 4 documented outbreaks of infections due to a compromised reprocess of urological endoscopes - New Delhi metallo-beta-lactamase (NDM-1) Klebisella in Shrewsbury, the UK[26]; Salmonella spp in Cartagena, Spain[27]; Enterobacter cloacae in Tainan, Taiwan[28]; and Pseudomonas aeruginosa in New Mexico, the USA[29]. As soon as a revised disinfection protocol has been implemented, the outbreaks of these infections were quickly arrested.

Following the outbreak of NDM-1 Klebisella in the UK, Koo et al. found that there was a great discrepancy on how flexible cystoscopes are disinfected and reprocessed in the UK.[26] A similar trend was also observed in France as well.[30] In a bid to overcome these inconsistencies, the American Urological Association (AUA) and Society of Urologic Nurses and Associates (SUNA) have published some guidelines and recommendations on how flexible cystoscopes should be reprocessed.[31] Furthermore, regular surveillance cultures and service of endoscopes have also been recommended to monitor and audit the quality of endoscope reprocessing.[32–34] In our centre, our

FIG. 2 Flow Chart for Endoscope Reprocessing including flexible cystoscopes, gastrointestinal endoscopes, and flexible bronchoscopes. © All rights reserved. *Infection Prevention and Control Guideline for Flexible Gastrointestinal Endoscopy and Flexible Bronchoscopy*. Public Health Agency of Canada, 2011. Adapted and reproduced with permission from the Minister of Health, 2018.



endoscopes are checked with Valisafe (Medisafe®, Bishop's Stortford, UK) weekly to ensure the highest possible disinfection.

It is a common knowledge that there is a growing resistance of bacteria against antibiotics.[35–38] In the wake of these nosocomial infections following endoscopic procedures and the rise of superbugs, there are calls to even review Spaulding classifications since it has been around for about 50 years[39,40] while others have recommended sterilization of endoscopes instead of high-level disinfection.[41,42] Alternatively, clinicians could opt for the use of single-use, disposable endoscopes which promise sterility over traditional reusable endoscopes.

Given the aforementioned advantages, it is no surprise there is a growing demand and interest for such single-use, disposable endoscopes. In urology, besides Isiris α™, there is 1 single-use diagnostic flexible cystoscope i.e. NeoFlex Cystoscope (NeoScope Inc., California, USA). As for single-use flexible ureteroscopes, at present, there are 7 different models in the market - PolyScope™ (Lumenis®, Israel. Polydiagnost, Germany), Semi-Flex Scope™ (Maxiflex®, Louisiana, USA), FlexorVue™ (Cook Medical®, Indiana, USA), LithoVue™ (Boston Scientific®, Massachusetts, USA), NeoFlex-Ureteroscope™ (Neoscope®, California, USA), and Uscope UE3011™ and UE5011™ (Zhuhai Pusen Medical Technology Co®, Zhuhai, China).[43] These single-use, disposable flexible ureteroscopes are reported to be non-inferior and comparable to traditional reusable flexible ureteroscopes.[43,44] Outside urology, there are single-use, disposable intubation endoscopes, bronchoscopes, gastroscopes,[45,46] and colonoscopes.[47] Interestingly, upper gastrointestinal surgeons have even used single-use, disposable Ambu® aScope 2™ (Ambu A/S, Ballerup, Denmark) which is a single-use flexible intubation endoscope to perform bile duct exploration successfully.[48,49] We speculate there will be more single-use, disposable endoscopes in the nearby future.

ISIRIS α™

Being a relatively new instrument in the market, the specifications of Isiris α™ have been compared against other classic flexible cystoscopies in the market, Talso et al. have reviewed Isiris α's image quality, flexibility and flow against 4 other digital flexible cystoscopes i.e. Olympus® CYF5, Olympus® CYF-VH, Storz® 11272C1, and Vision Science® CST 5000 EndoSheath in the laboratories.[50] In their study, they found that Isiris α's vision and water flow are comparable to other digital flexible cystoscopes although the field of view is noted to be narrower on Isiris α™. Nevertheless, Talso et al. have concluded that Isiris α™ is a viable and good alternative tool to remove ureteric stents. In another study, Doizi et al. have also reported clinicians praising Isiris α's image quality, deflection, maneuverability and grasper functionality.[51] More importantly, they have managed to remove 94% of the patients' stents successfully.

Besides presenting the ease and flexibility to remove ureteric stents on the wards and in clinics, less manpower required along with minimal delay is also observed to remove ureteric stents with Isiris α™. Such a trend is also observed in aScope™ as reported by Marshall et al. In our experience, we found that Isiris α™ was useful in removing ureteric stents in clinic when 2 of our patients attended our urology clinics to have their ureteric stents removed but only to find out their strings on their ureteric stents have been snapped. With Isiris α™, we managed to remove their ureteric stents on the same day, saving patients from coming back another day to the endoscopy department. Similarly, we also found Isiris α™ extremely useful in removing ureteric stents in a small peripheral hospital i.e. Llandrindod Wells in Wales where resources and facilities are very limited.

Although Isiris α™ is specifically designed to remove ureteric stents, Smith et al. have reported the successful use of Isiris α™ to remove foreign bodies in the urethra of a male patient who has psychiatric disorders and polyembolokoilamania in the accident and emergency department.[52] Therefore, Isiris α™ not only allows clinicians to remove ureteric stents easily, it is also a useful tool to remove foreign bodies in the urethra.

COST ANALYSIS

Cost analysis of single-use, disposable endoscope has been controversial. The most studied cost analysis of single-use, disposable endoscope is Ambu® aScope™. Studies by Gupta et al.[53], Aïssou et al.,[54]

Perbet et al.,[55] Marshall et al.,[56] have shown that the cost of using single-use, disposable aScope™ are comparable to traditional reusable optical scope. Furthermore, Marshall et al. also highlighted that less manpower is required to perform a successful intubation with aScope™.[56] This is also observed in our experience with Isiris α™ to remove ureteric stents. Another study by Tvede et al. however, have shown that it is more expensive to use aScope™ for intubation compared to reusable optical scopes.[57] They have thus recommended the use of aScope™ for intubation to centres that do not perform a high volume of intubation. A similar recommendation was also suggested by Perbet et al.[55] Edenharter et al. have developed a mathematical modelling software in a bid to help hospitals achieve the optimum cost-efficient mix of reusable and single-use devices.[58]

Recently, in urology, Ozimek et al. have done a cost analysis between LithoVue™ and reusable ureteroscopes.[59] They have concluded that LithoVue™ is a more expensive option for high-volume centres. However, LithoVue™ could represent a cost-effective alternative if it is used on selected patients who have large stone burden in the lower kidney pole or steep infundibulopelvic angle as these patient factors are likely to cause significant damage on reusable flexible ureteroscopes which translate to costly repairs. Contrary to Ozimek et al. findings, using the concept of micro-costing analysis, Taguchi et. al have evaluated the cost analysis of a single use ureteroscope i.e. LithoVue™ versus a reusable Olympus® URF-P6 flexible ureteroscope in the USA.[60] They have found the cost of using the 2 different endoscopes are very comparable after factoring in labour, maintenance cost, and consumables. With findings by Taguchi et al. and the additional benefits that a single use endoscope has over a reusable endoscope, the choice between the 2 types of ureteroscopes is an easy one.

For every ureteric stent removed, our hospital is paid £883 from Clinical Commissioning Groups (CCGs). No cost analysis has been performed before comparing Isiris α™ against traditional flexible cystoscopy in removing ureteric stent. We present the very first ever study comparing Isiris α™ against traditional flexible cystoscopy removal of stent. Smith et al. have done a small cost analysis on using Isiris α™ to remove foreign bodies in the urethra. Unsurprisingly, the use of Isiris α™ to remove foreign bodies in the urethra in the emergency department was found to be about 3 times cheaper than performing a similar procedure with a rigid cystoscope under general anaesthesia in an emergency theatre.

From our study, we found that using a flexible cystoscope is relatively cheaper compared to Isiris α™ to remove ureteric stents as expensive hardwares such as reprocessing machines, stacks,and storage cabinets are also used by other endoscopes in the department. Furthermore, unlike Isiris α™, traditional flexible cystoscope is designed for several purposes such as diagnostic, stent removal, and cystodiathermy and biopsy for small bladder lesions. However, there are incalculable hidden costs, such as failure of a cleaning cycle or accidental contamination prior to use. Ideally the contamination is noticed and rectified but when missed, there may be a significant overall morbidity caused from urinary tract infections just like in Koo et al. and Wendelboe et al. reports. This is less likely with Isiris α™ due to fewer steps before use

LIMITATIONS

All studies have their own limitations. Our study is not one without. One of the limitations of our study is that the price of consumables may vary from other hospitals, depending on the size of purchase by the hospital from the relevant pharmaceutical companies. Needless to say, pharmaceutical companies would be able to offer hospitals discounts if a bulk purchase is made. For example, Coloplast® will be in a position to offer a free LCD monitor if a hospital orders 25 Isiris α™. In order to ensure a fair calculation, we have based our calculations on recommended retail price for all items in our data analysis. Secondly, with only 20 patients in our study, it is indeed a small study. Certainly, a large study will be required to calculate the cost effectiveness more accurately especially in large volume centres. In our study, we have not included the disposable cost of the items which we dispose at the end of the procedure.

CONCLUSION

Although Isiris α™ is shown to be a more expensive option to remove ureteric stents based on our

analysis, it still provides clinicians flexibility and ease in removing ureteric stents in the outpatient clinic, reducing the pressure and demand for dedicated flexible cystoscopy slots in the endoscopy department.

Isiris α™ can be used immediately on demand out of hours, when the endoscopy department may not be readily available. Additionally, it can be used independently by clinicians without the need to assemble a team of dedicated endoscopy staff. These benefits are also applicable to rural locations without an established endoscopy unit. This flexibility may in turn prevent unnecessarily long journeys for patients in remote areas.

CONFLICT OF INTEREST STATEMENT

Ten Isiris α™ and a monitor were provided free of charge by Coloplast® to run this study.

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APPENDIX 1 Breakdown of Cost for Each Patient Who Had His/Her Ureteric Stent Removed by an Isiris α™

Patient	Reason for Stent	Dwell Time (Day)	Removal Delay (Day)	Procedure Time (Min)	Disposable (£)	Isiris α + Monitor (£)	Labour Cost (£)	Total Cost (£)
1	Left Ureteric Biopsy	23	0	5	7.66	251.59	2.80	262.05
2	Left Ureteric Biopsy	23	0	2	7.66	251.59	1.12	260.37
3	Left Ureteric Biopsy	20	0	2	7.66	251.59	1.12	260.37
4	Left Ureteroscopy For Stone	13	0	1	7.66	251.59	0.56	259.81
5	Left Ureteroscopy For Stone	16	0	3	7.66	251.59	1.68	260.93
6	Right Pyelolithotomy	130	0	3	7.66	251.59	1.68	260.93
7	Left Ureteric Biopsy	16	0	2	7.66	251.59	1.12	260.37
8	Left Ureteroscopy For Stone	9	0	1	7.66	251.59	0.56	259.81
9	Right Ureteroscopy For Stone	16	0	2	7.66	251.59	1.12	260.37
10	Left Ureteroscopy For Stone	13	0	4	7.66	251.59	2.24	261.49

APPENDIX 2 Breakdown of Cost For Each Patient Who Had His/Her Ureteric Stent Removed by a Flexible Cystoscope in the Endoscopy Department

Patient	Reason for Stent	Dwell Time (Day)	Removal Delay (Day)	Procedure Time (Min)	Endoscope (£)	Endo Service (£)	Stack (£)	Stack Service (£)	Reprocessing Hardware (£)	Reprocessing Service (£)	Reprocessing Per Cycle (£)	Reprocessing Staff Cost (£)	Electric + Water Cost (£)	Disposable (£)	Labour Cost (£)	Total (£)
1	Left ureterolysis for Retroperitoneal Fibrosis	60	27	5	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	5.64	117.32
2	Left Ureteric Injury During Hartmanns	46	3	20	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	22.57	134.25
3	Iatrogenic Injury During Caesarean Section	45	3	5	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	5.64	117.32
4	Distal Ureterectomy and Reimplantation	38	0	7	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	7.90	119.58
5	Left Ureteric Injury During Hartmanns	58	2	15	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	16.93	128.61
6	Left Open Pyeloplasty	43	0	10	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	11.29	122.96
7	Left Ureteroscopy + Laser Distal Ureteric Tumour	28	0	12	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	13.54	125.22
8	Right Ureteroscopy for Stone	30	0	8	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	9.03	120.71
9	Left Open Pyeloplasty	62	20	7	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	7.90	119.58
10	TURBT around Left Ureteric Orifice	30	9	15	12.33	27.15	0.60	1.81	7.62	12.12	10.94	10.32	0.38	28.41	16.93	128.61