

Background

Flexible ureteroscopes (fURS) are used in the treatment of a variety of upper urinary tract pathologies, primarily stone disease.¹ These devices are expensive² and fragile endoscopes.³ Their small size also presents challenges for decontaminating fURS during the sterilization process⁴ with cleaning guidelines classifying these devices as high-risk endoscopes.⁵ Recently, single-use fURS have become effective alternatives to reusable fURS.⁶

Single-Use Digital Flexible Ureteroscope (fURS)



Image courtesy of Becton Dickinson and Company.

Objective

The objective of this analysis is to inform organizations evaluating single-use fURS on the various costs associated with reusable fURS.

Methods

A comprehensive literature review of the various costs associated with reusable fURS was undertaken. When available, the findings of systematic reviews and meta-analyses were employed, and when not, the mean values from three or more studies were utilized. The costs analyzed included the amortized acquisition cost of the fURS, reprocessing costs, repair costs, incremental operating room time, and the incremental cost associated with postoperative infections. An estimated 100 uses of a reusable fURS was employed in the model.

Results

Two systematic review and meta-analyses were used for the acquisition cost of reusable fURS and the average per-case repair costs. The incremental infection risk associated with reusable fURS was based on two studies of post-operative infections. The amortized acquisition cost modeled was half the value reported by others.⁷ The model yielded a cost per procedure of \$1,767 (€1,679) when individual reusable fURS are used for 100 procedures each year.

Limitations

The limitations of this model include but are not limited to:

- None of the values in the model were adjusted for inflation to today's currency values and thus results may be understated.
- The various values cited come from multiple countries and primarily from academic medical centers. Selecting mean values may have produced more conservative results, however, smaller tertiary care organizations may wish to consider further adjustment.

Conclusions

The total cost per procedure associated with fURS in this analysis – \$1,767 (€1,679) – aligns well with the work of others. Mager, et al considered only repair and acquisition costs and estimated the cost per procedure to be \$1,212– \$1,743 (€1,151–€1,656).⁹ Taguchi, et al considered all of the costs in this analysis, except the incremental infection risk, and estimated the per-procedure cost for reusable fURS to be \$2,799 (€2,659).⁷

Organizations may wish to employ this model as a template, adjusting the parameters based on their costs, history, and experience with reusable fURS.

KEY FINDINGS

- When considering amortized acquisition costs, reprocessing costs, repair costs, incremental operating room time, and incremental costs associated with postoperative infections, the total per-procedure cost associated with reusable flexible ureteroscopes was found to be \$1,767 (€1,679).
- Organizations should employ this model as a template; adjusting the parameters based on their costs, history, and experience; to determine the total per-procedure costs specific to their facilities.

Model

Per-Procedure Costs of Reusable fURS

Amortized Acquisition Cost		
5	lifetime (years)	Note A
\$27,316	purchase cost	Note B
100	uses/year	Note C
\$55	per procedure	
Reprocessing Cost		
\$104	per procedure	Note D
Repair Cost		
\$441	per procedure	Note E
Incremental OR Time		
16.5	minutes	Note F
\$36	dollars/minute	Note G
\$594	per procedure	
Incremental Infection Cost		
9.40%	infection risk	Note H
\$6,101	cost per infection	Note I
\$573	per procedure	
Total Cost Per Procedure		
\$1,767	(€1,679)	

Notes

- Mean of the lifetimes reported by Taguchi – 3 years,⁷ Al-Balushi – 4 years,⁸ and Mager – 9 years.⁹
- Mean of the lowest of the four purchase cost ranges cited by Ventimiglia: \$20,200; \$13,611; \$17,452; and \$58,000.²
- Estimate: 100 uses/year = 1 use/day x 2 flexible ureteroscopy surgery days/week x 50 weeks/year
- Mean of the reprocessing costs reported by Isaacson – \$96,¹⁰ Taguchi – \$107,⁷ and Mager – \$108.⁹
- Average repair cost per procedure – 18-study meta-analysis.¹¹
- Mean of the additional operating room (OR) time in minutes required with reusable fURS reported by Göger – 10.9,¹² Usawachintachit – 14.5,¹³ Taguchi – 19.8,⁷ and Salvador – 20.9.¹⁴
- Mean of the per-minute cost of OR time reported by Pietropaolo – \$10,¹⁵ Childers – \$37,¹⁶ and Giroto – \$60.¹⁷
- Mean of the incremental post-procedure infection rates with reusable fURS reported by Unno – 5.4%,¹⁸ and Bozzini – 13.3%.¹⁹
- Cost of a hospital-onset non-catheter-associated urinary tract infection that does not progress to secondary bacteremia and the length of stay is less than or equal to 10 days.²⁰

Discussion

Organizations may also wish to consider other factors when considering single-use fURS:

- The carbon footprint of single-use fURS will be a factor for some organizations. A detailed analysis found the environment costs of single-use and reusable fURS to be comparable with the greatest carbon dioxide contribution of reusable fURS being associated with washing and sterilization.²¹
- Some researchers found that implementing a hybrid strategy – using both reusable and single-use fURS – with the goal of using single-use fURS on the high-risk-for-breakage cases has a favorable impact on the economic management of certain patients.²²

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