Disposable flexible cystoscopes for removing double J catheter: A budget impact analysis

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ABSTRACT

Introduction: This study conducts a budget impact analysis to evaluate the cost of removing double J catheters using single-use flexible digital cystoscopes compared to reusable cystoscopes at the CHU de Québec.

Methods: The UETMIS of CHU de Québec estimated average costs per intervention for both reusable and single-use flexible cystoscopes in the endoscopy room. Costs included purchase, repair, reprocessing, and sterilization for reusable cystoscopes based on data from 2017–2019. For single-use cystoscopes, the unit price and technical platform costs were considered. Annual costs were calculated using the average cost per procedure and the annual volume of double J catheter removals.

Results: The average cost per intervention for

KEY MESSAGES

- Using single-use flexible digital cystoscopes for removing double J catheters would be nearly twice as expensive compared to reusable cystoscopes.
- For 385 double J catheter removals per year, the additional cost would be approximately $55 760, primarily driven by the purchase price of single-use cystoscopes.
- Cystoscope breakage is an infrequent event, with only 204 repair requests documented across 19 615 cystoscopies in two financial years.
- While currently not cost-effective, the potential implementation of patient-focused financing in the future might change the economic evaluation of single-use cystoscopes.
- New disposable cystoscopes have been developed specifically for ureteral catheter extraction, potentially offering advantages in reducing maintenance and sterilization complexities.

reusable flexible cystoscopes was estimated at $148.55, while for single-use digital flexible cystoscopes, it was $293.38. For 385 annual double J catheter removals, the total cost would be $57 191.75 with reusable cystoscopes and $112 951.30 with single-use cystoscopes. This represents an additional cost of $144.83 per procedure or $55 760 annually when using single-use cystoscopes.

Conclusions: The use of single-use flexible digital cystoscopes for double J catheter removal at CHU de Québec would nearly double the cost per procedure compared to reusable cystoscopes. This cost difference is primarily due to the purchase price of single-use devices. While cystoscope breakage is infrequent, the potential for higher breakage risk during double J catheter removal could reduce the cost differential. Future implementation of patient-focused financing might alter the economic evaluation of single-use cystoscopes.

INTRODUCTION

Ureteral catheters are of frequent use in urology. They are use so that the urine can pass easily between the kidney and the bladder after a urologic intervention. Usually, they can be extracted by the patient by pulling on a thread that is attached to the catheter. For some patients, the catheter must be extracted by a urologist by using reusable cystoscope in an endoscopy room or an operating room.

Recently, disposable cystoscopes have been developed, like the Isiris™ from Coloplast or the Neoflex™ from Neoscope. Others are on the market but have not been yet approved by Health Canada.

The flexible Isiris™ has been created especially for the extraction of ureteral catheter. On this cystoscope, there is no working channel, there is only pliers and a channel for the irrigation and aspiration of liquid. It is supposed that those tools could reduce the inconvenience of the number of breaking of the reusable cystoscope and their maintenance and could limit the use of special rooms for the extraction of ureteral catheters.

In the following study, a budget impact analysis was carried out to evaluate the unit cost of removing a double J probe in the endoscopy room with a single-use flexible digital cystoscope compared to a reusable one in the CHU de Québec.

METHODS

The study was conducted by the UETMIS (Unité d'évaluation des technologies et des modes d'intervention en santé) of the « CHU de Québec » (CHUQ).

The average costs per intervention of reusable flexible cystoscopes and single-use digital flexible cystoscopes in the endoscopy room were estimated for the Quebec City University Hospitals. For reusable flexible cystoscopes, the purchase cost (cystoscope and forceps for removing double J probes), repair costs as well as reprocessing and sterilization costs were estimated from data collected during the financial years 2017-2018 and 2018-2019. The initial

purchase costs of the reusable flexible cystoscopes and the forceps used to remove the double J catheters were transmitted by the Procurement Department and the outpatient consultation teams. A six-year depreciation was applied to calculate the annual purchase cost of cystoscopes and a two-year depreciation was applied for forceps. The amortization period of the cystoscopes was determined according to the standardized lifespan as set by the Ministry of Health and Social Services of Quebec. That of the forceps for removing double J probes comes from an estimate of the useful life recommended by the outpatient consultation teams of the CHU de Québec. The purchase costs of the sterilization boxes and the video monitor were not included in the calculations.

Interal maintenance software was consulted by the Department of Biomedical Technologies to identify the total cost of repairs of reusable flexible cystoscopes during the 2017-2018 and 2018-2019 financial years. The costs of reprocessing and sterilization, including the products used and human resources time was included. The average cost per procedure was estimated for the flexible reusable cystoscopes in three hospitals of the CHU de Québec (Hôpital de l'Enfant-Jésus, Hôtel-Dieu de Québec, Hôpital de Saint-François d'Assisse).

The average cost per intervention associated with the use of single-use flexible digital cystoscopes for the removal of a double J probe was estimated by considering the unit prices of the Isiris^{TM} cystoscope and the cost of the technical platform of endoscopy.

The total annual costs for the removal of double J catheters using a reusable flexible cystoscope and with a single-use cystoscope in the endoscopy room were calculated from the average cost per procedure and the annual volume of cystoscopies performed for the removal of a double J probe (data collected between September 16, 2018 and September 16, 2019).

RESULTS

The estimated cost of purchasing reusable flexible cystoscopes for the cystoscopy rooms of outpatient consultations at the CHU de Québec is presented in Table 1. The total purchase cost of the 58 cystoscopes currently available at the HDQ, the HEJ and the HSFA is $687,600. Considering cost amortization over six years, the total annual cost of cystoscopes is $114,600 or $229,200 over two years. Considering the performance of 19,615 cystoscopies over a period of 2 years (2017-2019), the average cost per intervention is estimated at $11.70.

The costs of purchasing the pliers needed to remove a double J probe vary depending on the model used, from $569 to $1,200 per unit. The cost of purchasing the 21 forceps currently available in the cystoscopy rooms of the Quebec University Hospital is $14,091 or $7,045 per year. The lifespan of pliers is estimated at around two years. The number of cystoscopies performed with the use of forceps is difficult to estimate, forceps being used for the removal of double J probes but also for performing biopsies or for the removal of urolithiasis or foreign bodies. Assuming that the 21 clamps were used for the 385 double J catheter removals recorded between September 16, 2017 and September 16, 2018, the average cost per intervention relating to the clamp purchase component would amount to 18.30 $. Note that breakage and repair costs of the clamps would also have to be considered.

The cost estimate for repairs of reusable flexible cystoscopes for the 2017-2018 and 2018-2019 fiscal years is presented in Table 2. Of the 19,615 cystoscopies performed during these two financial years, 204 requests for repair were documented. The total cost of these repairs is $738,014, or $369,007 per year. The average cost of a repair is $3,618. The average cost of cystoscopy repairs is estimated at $37.60. At the HDQ, estimates include costs relating to preventive resurfacing, an approximate amount of $90,000 per year. The unit cost for reprocessing and sterilization of a reusable flexible cystoscope is estimated at $30.87. The cost of using the technical platform is estimated at $68.38 per cystoscopy including $37.15 for the purchase of single-use equipment and $31.23 in human resources. The estimate of the total annual cost and the average cost per intervention relating to the use of reusable flexible cystoscopes for the removal of double J probes in the endoscopy room at the Quebec University Hospital is presented in Table 3. The total cost related to the Use of reusable flexible cystoscopes is estimated at $57,191.75 per year, assuming that 385 double J catheter removals are performed annually. The estimated average total cost per intervention is $148.55. Note that the costs related to the use of forceps were not included in the calculations due to the lack of information regarding the number of cystoscopies performed with the use of forceps.

The unit price of a single-use flexible digital cystoscope, the Isiris from the company Colopast, is $225 (excluding taxes and delivery). The reusable video monitor would be on loan from the company. The cost of an intervention for the removal of a double J probe in the endoscopy room with a single-use flexible digital cystoscope is $293.38 (including the purchase cost of the cystoscope and the cost of the tray technique) for a total of $112,951.30 for 385 double J catheter removals carried out annually.

DISCUSSION

Thus, analysis of financial data suggests that the costs associated with the use of single-use digital flexible cystoscopes to remove double J probes in the endoscopy room would be nearly double those associated with the use of reusable flexible cystoscopes. Considering the costs of using the fleet of available flexible cystoscopes (costs of purchases, repairs, reprocessing and the endoscopy technical platform), it would cost $144.83 more per intervention to remove the double J probes with a single-use flexible digital cystoscope at the CHU de Québec, representing an annual amount of $55,760 for the removal of 385 double J probes per year. Assuming that the breakage rate attributable to the removal of double J probs corresponds to the proportion of interventions carried out in cystoscopy for this same activity (3.6%), it would be necessary to subtract from the previous total amount the costs of repairs which amount to $13,284 per year. The cost differential between the use of single-use and reusable cystoscopes could be less if we assume that the risk of cystoscope breakage is higher during double J catheter removal procedures due to the insertion of a pliers in the working channel and the level of experience.

Certain limitations related to this evaluation should be considered when interpreting the results. Data were collected manually from information recorded in the ADT management systems (for the volume of removal of double J catheters by cystoscopy) and the Intéral database

(volume and costs of repairs) to estimate the volumes of intervention and breakage. Other cost components, such as those associated with the administrative management of cystoscopes (ordering, transport, storage, disposal), purchase and repair costs of forceps and video monitors were not considered. Another limitation to take into consideration would be the cost of the single-use cystoscope. In this budget impact analysis, we compared the model Isiris™ to reusable cystoscopes with a selling price of $225 from 2017 to 2020. As for now, there is no other single-use cystoscope with integrated pliers, but this price will likely change in future years as initial patents expire and more cystoscopes become available. Thus, this analysis will have to be revised soon.

Finally, for clinics performing fewer procedures, the initial capital outlay for reprocessing equipment and facility space costs for sterilization areas should be factored into the cost analysis. This consideration is particularly relevant for rural practices and new surgical centers where the volume of procedures may not justify the fixed costs associated with reusable equipment. Unfortunately, in our report, we did not explicitly state how many reusable cystoscope procedures are needed to be cost-effective compared to disposable ones. However, according to the study "Micro-cost analysis of single-use vs. reusable cystoscopy in a single-payer healthcare system," reusable cystoscopes become more cost-effective than single-use cystoscopes if more than 1265 procedures per year are performed.[1] In this study, the cost of the cystoscopes without pliers was like the cost of our cystoscopes with pliers. Therefore, the decision between reusable and disposable cystoscopes should be based on the specific circumstances of each clinic.

CONCLUSIONS

To conclude, more than 10,500 cystoscopies are performed annually in the endoscopy rooms of the CHU de Québec, including 3.6% removals of double J probes. According to the results of this financial impact analysis, the use of a single-use flexible digital cystoscope in the endoscopy room for the removal of double J probes would be associated with an increase in the cost per procedure equivalent to almost double the current cost estimated with the use of reusable flexible cystoscopes. The difference in cost is mainly explained by the purchase cost of the single-use cystoscope and the impact of the high number of cystoscopies performed each year at the Quebec University Hospital on the unit cost of using reusable cystoscopes. The data collected as part of this report indicate that the occurrence of cystoscope breakage is an infrequent event with the consequence that the cost of repairs per intervention with reusable cystoscopes remains low. The available data does not make it possible to determine whether the removal of double J probes constitutes a significant source of breakage, thus limiting the possibility of making assumptions about reducing repair costs in connection with the use of single-use cystoscopes. However, the cost differential between the use of single-use and reusable cystoscopes could be less if we assume that the risk of cystoscope breakage is higher during double J catheter removal procedures. It also seems, according to the information collected, that a disruption in cystoscopy services when a reusable flexible cystoscope is under repair is unlikely since the equipment currently available in the various hospitals of the Quebec City University Hospital would be

sufficient to avoid this risk. In this context, it was not necessary to take into consideration the impact of a disruption in cystoscopy service when assessing costs.

Two economic studies identified as part of this evaluation report focused on the evaluation of the costs related to the removal of a double J probe with a single-use digital flexible cystoscope in a clinical context other than an endoscopy room or an operating room.[1,2] In one study, savings from the introduction of single-use cystoscopes were solely linked to reduced operating room costs.[2] These results cannot be applied directly to the context of the Quebec University Hospital since cystoscopy activities have already been transferred from the operating room to outpatient consultations in 2017. The other study was carried out in a health system where hospitals are paid to activity.[3] In this context of remuneration for hospital establishments, the release of time slots in endoscopy for the removal of double J probes has made it possible to increase the number of interventions and the income generated annually in cystoscopy. The increase in revenue was much greater than the additional costs related to the purchase of single-use cystoscopes. These results would also not be applicable to the Quebec University Hospital in the current hospital remuneration system in Quebec. However, a patient-focused financing method which should soon be implemented represents an opportunity to analyze differently the improvement of access to care which requires a technical platform.

Before we conclude this paper, another aspect that would be important to take in consideration is the environmental impact of those single-use cystoscope. Currently they generate 7.4% less procedural waste than reusable models (622 g vs. 671.5 g per case) but produce 353% higher lifecycle carbon emissions (2.40 kg vs. 0.53 kg CO_2) due to manufacturing and incineration impacts. While single-use devices eliminate sterilization water needs, reusable systems conserve 235,200 liters over their operational lifespan, highlighting critical trade-offs between immediate resource use and long-term environmental burdens.[4,5] Although, in a more recent literature review on this subject, the authors demonstrated disparate results depending on the calculation method used for carbon footprint analysis. However, the results tend rather toward a lower environmental impact of single-use devices.[6]

Thus, in the current financing system, introducing single-use cystoscopes would increase costs for CHU de Québec. However, this assessment may need revision in the future, considering patient-oriented financing and environmental factors. The decision to adopt single-use cystoscopes should balance financial, clinical, and environmental considerations.

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FIGURES AND TABLES

Table 1. Estimate of the average cost per intervention related to the purchase of reusable flexible cystoscopes at the CHU de Québec by hospital, financial years 2017–2018 and 2018–2019

Hospital	Reusable flexible cystoscope			Intervention (n)[2]	Average cost per intervention ($)
	n	Total cost of purchase ($)	Total amortized cost ($)[1,2]		
HDQ	35	462 000	154 000	7 990	19,30
HEJ	8	105 600	35 200	8 016	4,40
HSFA	15	120 000	40 000	3 609	11,10
Total	**58**	**687 600**	**229 200**	**19 615**	**11,70**

[1]Amortization over 6 years ($). [2]Amortization over two years (2017–2019). Sources: Procurement and contract management department and Urology department of the CHU de Québec HEJ: Hôpital de l'Enfant-Jésus; HSFA: Hôpital de Saint-François d'Assise; HDQ: Hôtel-Dieu de Québec.

Table 2. Estimate of the average cost of repair per intervention related to the use of reusable flexible cystoscopes at the CHU de Québec per hospital, financial years 2017–2018 and 2018–2019

Hospital	Total repair cost ($)	Repair		Intervention	
		n[1]	Average cost per repair ($)	n[1]	Average cost per repair ($)
HDQ	460 857	135	3 414	7 990	5770
HEJ	164 735	37	4 452	8 016	2060
HSFA	112 422	32	3 513	3 609	3120
Total	**738 014**	**204**	**3618**	**19 615**	**3760**

[1]Over two years (2017–2019). Sources: Intéral Management System and Biomedical Technologies Department of the CHU de Québec HEJ: Hôpital de l'Enfant-Jésus; HSFA: Hôpital de Saint-François d'Assise; HDQ: Hôtel-Dieu de Québec.

Table 3. Estimate of the average total cost per procedure and of the total annual cost related to the use of reusable flexible cystoscopes at the CHU de Québec per hospital

Hospital (n double J catheter removal[1])	**Cost per double-J catheter removal**				**Average total cost per intervention ($)**	**Annual total cost ($)**
	Cystoscopes purchase	**Cystoscopes reparation**	**Reprocessing and sterilization**	**Technical platform**		
HDQ (n=103)	19.27	57.68	30.87	68.38	176.20	18 148.60
HEJ (n=161)	4.39	20.55	30.87	68.38	124.19	19 994.59
HSFA (n=121)	11.08	31.15	30.87	68.38	141.48	17 119.08
CHU de Québec (n=385)	**11.68**	**37.62**	**30.87**	**68.38**	**148.55**	**57 191.75**

[1]Number of double-J catheters removed at HSFA, HDQ, and HEJ between September 16, 2018, and September 16, 2019. HEJ : Hôpital de l'Enfant-Jésus; HSFA : Hôpital Saint-François d'Assise; HDQ : Hôtel-Dieu de Québec.