The Hospital for Sick Children

Technology Assessment at SickKids (TASK)

THE COST-EFFECTIVENESS OF CLINIC-BASED CHLORAL HYDRATE SEDATION VERSUS GENERAL ANAESTHESIA FOR PAEDIATRIC OPHTHALMOLOGICAL PROCEDURES

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REPORT HIGHLIGHTS

The Report Highlights consists of a summary of the full report with the same name and should be evaluated in conjunction with the full report and its appendices. Full documents are available for download at:

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Conflicts of interest

The authors declare no conflicts of interest.

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Introduction

Eye examinations in children are pain free but some children find the use of bright lights and close proximity to equipment or a doctor distressing. The inability to tolerate detailed eye examinations whilst awake often necessitates the need for sedation or general anesthesia (GA).[1] Performing eye exams under anesthesia (EUA) in the operating room (OR) is the current standard of care.[2] GA can be costly and pose additional risks to the child. Recently, there have been concerns regarding the influence GA may have on neurodevelopment in patients who require multiple exams.[3,4]

An alternative is oral chloral hydrate sedation which can be administered in a hospital-based ophthalmology clinic by a trained nurse.[1,5,6]

The safety and effectiveness of eye examinations under sedation (EUS) in the clinic was recently demonstrated in a large retrospective study of 813 patients at The Hospital for Sick Children (SickKids). [1]

Key Messages

- Children may need to undergo general anaesthesia even for painless routine eye examinations.
- Clinic-based oral sedation administered by a trained nurse offers an attractive alternative.
- In a cross-over cost-effectiveness analysis in eighty children, the average cost per patient for conducting ophthalmologic procedures was $406 for oral sedation compared to $1,136 for general anaesthesia, representing an average savings of $729 per patient.
- All planned ophthalmologic procedures could not be completed in 11% of oral sedation patients.
- Assuming that incomplete procedures would be conducted under general anaesthesia on a repeat visit, oral sedation still resulted in an average savings of $555 per patient.
- Clinic-based oral sedation represents an easily adopted hospital-based intervention with negligible set-up costs, with savings that can accrue even when patient throughput is low.
- Exams carried out under general anaesthesia may be more appropriate when a large number of procedures are required in a single session.

As health care spending continues to increase, there is a growing need for improved efficiencies within publicly funded systems. This includes the consideration of cost-saving hospital-based technologies that result in improved health outcomes.[7] The ability to carry out paediatric eye examinations under chloral hydrate sedation in a nurse-led outpatient clinic may be a safe and cost-effective alternative to EUA. Also, for a parent accompanying their child, a shorter visit to the clinic would mean less time away from work or other commitments.

Objectives

The primary objective was to conduct a cost-effectiveness analysis to assess the incremental costs of paediatric ophthalmologic eye examinations carried out in a nurse-led outpatient sedation unit using oral chloral hydrate compared to exams carried out in the OR per successful procedure gained from a societal perspective. A secondary objective was to conduct a cost-minimization analysis under assumptions of equivalent effectiveness between clinic-based sedation and GA.

Methods

A cross-over cost-effectiveness analysis was carried out from a societal perspective to compare costs and outcomes of eye examinations carried out under sedation to eye exams carried out under anaesthesia. The analysis was performed retrospectively using data from 80 pediatric ophthalmology patients that had an EUS within seven months (prior to or following) an EUA at the Hospital for Sick Children (SickKids), Toronto, Canada. All costs and outcomes within the short-term episode of care representing a patient's length of stay were measured. Costs included direct health care costs including all medical personnel and services, supplies and equipment used for sedation and GA, as well as parent or caregiver productivity losses. Effectiveness and safety were assessed based on the number of successful ophthalmological procedures completed per exam (one to three procedures were planned per exam) and the number of adverse events in each group. Adverse events of interest included paradoxical reactions, desaturation, nausea and vomiting, prolonged sedation, and reduced heart rate. To address uncertainty, one-way sensitivity analysis was conducted for select cost variables and a

probabilistic sensitivity analysis was conducted using 1,000 Monte Carlo simulations. Mean costs with 95% confidence intervals (CIs) were estimated for all cost-effectiveness findings.

Results

All 80 patients experienced successful eye examination under GA, with 100% of planned procedures completed. In the EUS group, 88% of exams were completely successfully with 89% of planned procedures completed. Three adverse events were observed in two EUS patients compared to 1 adverse event in the EUA group. One EUS patient experienced a paradoxical reaction (hyperactivity) and the other a combined case of oxygen desaturation and prolonged sedation. In the EUA group, one patient experienced hypertension and tachycardia which were believed to be reactions to eye drops used during the ophthalmology exam.

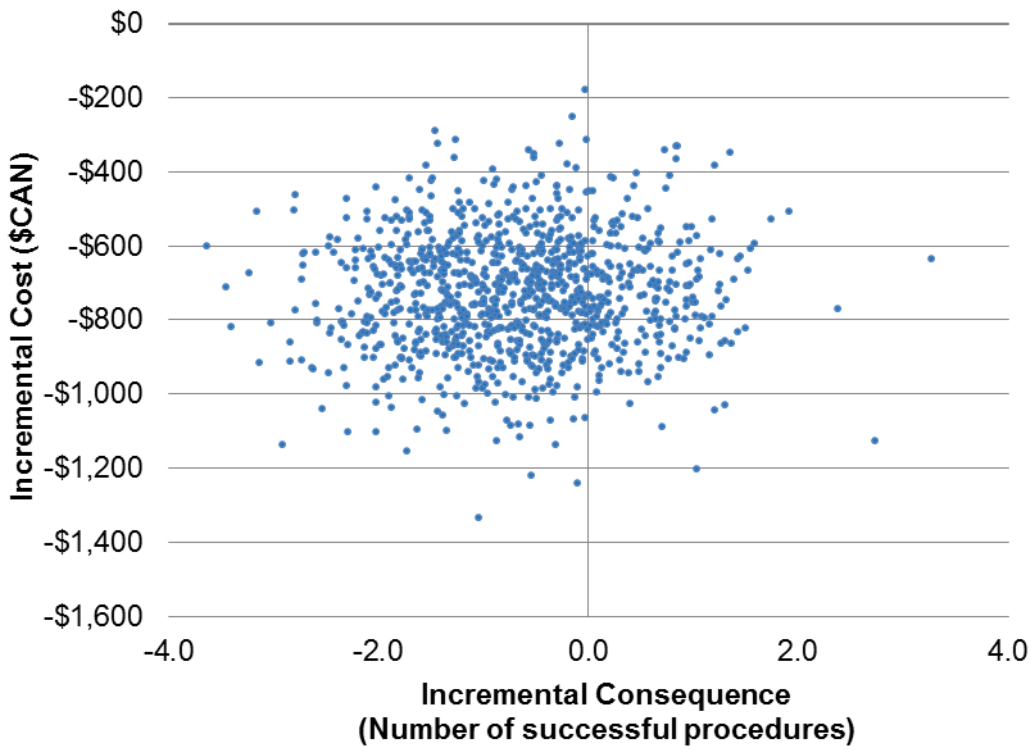
Outcome (n=80 patients)	EUS (clinic)		EUA (OR)		p Value*
	n	%	n	%	
Successful exams	67	83.8%	80	100%	<0.0001
Successful procedures per group	109	89.3%	162	100%	<0.0001
Adverse events per group	3	3.8%	1	1.3%	<0.0001

* Paired t-test

While fewer procedures were successfully completed in the EUS group, the probabilistic analysis demonstrated that mean costs were significantly less in the EUS group, $406 per patient (95% CI $401, $411) compared to EUA, $1,135 (95% CI $1,125, $1,145) per patient. EUA was an average of $729 more costly per patient than EUS and resulted in an additional 0.68 successful procedures per patient exam.

Strategy	Mean cost per patient (95% CI)	Mean no. successful procedures per patient (95% CI)	Incremental cost (95% CI)	Incremental number of successful procedures (95% CI)
EUS (clinic)	$406 ($401, $411)	1.39 (1.34, 1.42)	-$729 (-$738, -$719)	-0.678 (-0.738, -0.618)
EUA (OR)	$1135 ($1125, $1145)	2.06 (2.02, 2.11)		

As seen in the scatterplot below, while EUS was less costly than EUA in 100% of the model simulations, EUS was more effective (more procedures completed per patient) than EUA in 23% of the simulations.



In the cost minimization analysis, when failed sedations in the clinic were assumed to be completed in the OR, the mean cost of EUS per patient increased to $586 (95% CI $438, $735), but remained significantly less than EUA. A strategy whereby patients attempted an eye exam in the clinic first, and if needed (due to failed sedation), underwent a second visit in the OR, resulted in mean cost savings of $555 per patient (95% CI $283, $818).

Conclusions

Hospital budgets are under increasing pressure to rationalize care. Interventions that reduce costs despite being slightly less effective can result in more efficient allocation of healthcare resources when the trade-off between costs and outcomes does not pose morbidity or mortality risks. EUS represents an easily adopted hospital-based intervention with negligible set-up costs, with savings that can accrue even when patient throughput is low. Results from this study demonstrated significant savings when ophthalmologic exams were carried out in an outpatient clinic using chloral hydrate sedation, albeit with fewer procedures completed per exam. When taking into account the proportion of failed sedations that have to be repeated in the OR, the clinic approach remained cost-saving. Exams carried out in the OR under GA may be more appropriate when a large number of procedures per patient are required.

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