Surgery versus collagen for female stress urinary incontinence: economic assessment in Ontario and Quebec

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Introduction and objective: *The purpose of this study was to evaluate the cost-effectiveness of surgery versus collagen injection to treat female stress urinary incontinence after the failure of initial surgical treatment. The analysis was conducted from the health care system perspectives of Ontario and Quebec.*
Materials and methods: *A decision-tree was constructed to compare each of three surgeries (i.e., retropubic suspension, transvaginal suspension, sling procedures) with collagen. An average cost estimate was generated for each intervention, as was an incremental cost-effectiveness ratio for each surgery-collagen comparison.*
Results: *In both Ontario and Quebec, the treatment with the lowest average cost was collagen (Ontario: collagen = $2695; Quebec: collagen = $2718). However, the surgeries had higher probabilities of success (defined as 'cure' – no urine leakage during follow-up examinations), with point estimates of at least .79 (.53 for collagen). Incremental cost-effectiveness ratios for the base case analyses of all treatment comparisons indicated that the cost to cure an additional patient with surgery could range from $1824 to $6814 in Ontario and $1388 to $3008 in Quebec. These ratios were sensitive to changes in the mean number of injections for collagen patients and to a reduction in the length of hospital stay for surgery to 1 day.*
Conclusions: *Collagen injection may be cost-effective as a follow-up treatment to initial surgical failure in both Ontario and Quebec when the number of injections is kept to a minimum and hospital stays after surgery are relatively lengthy. Otherwise, surgery may be cost-effective.*

Key Words: female stress urinary incontinence, surgery, collagen injection, cost-effectiveness

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Introduction

Stress urinary incontinence (SUI) is the involuntary loss of urine accompanying an increase in intra-abdominal pressure. Surgery is the standard intervention when non-invasive therapies (e.g., bladder retraining, pelvic floor exercises) cannot control the problem. Despite the overall success of surgery (i.e., cure rates on average in excess of 80%[1]), some patients remain incontinent. Estimates suggest 7% (range: 0% to 17%) of patients have recurrent SUI following Burch colposuspension, and 6% (range: 0% to 24%) following sling procedure.[2] Further treatment with surgery is an option for many of these patients.

Collagen injection (Contigen®, Bard Canada Inc., Mississauga, Ontario) is also an option for many types of patients in whom initial surgical treatment failed.[2,3] Although commonly thought to be indicated for patients with intrinsic sphincter deficiency and without urethral hypermobility, collagen has demonstrated good results in the treatment of all types of SUI (including SUI with hypermobility).[4-10]

Fiscal pressure in the Canadian health care system heightens the importance of studying the cost-effectiveness of treatment options that may be undertaken after failed initial therapy. Relative to surgery, collagen may be a less costly alternative because it is an outpatient procedure usually performed under local anesthetic. Also, it has a lower complication rate than surgery.[1,11]

This study employs decision analysis to examine the cost-effectiveness of surgery versus collagen injection in the treatment of female SUI after initial surgical failure.

Methods

Cost-effectiveness was assessed from both the Ontario and Quebec health care system perspectives, which include the direct costs of treatment (e.g., physician fees) and exclude indirect costs borne by patients and caregivers (e.g., lost income during convalescence due to an inability to work).

The analysis considered all of the resources and costs associated with one additional course of treatment (with either surgery or collagen) following an initial surgical failure. This included treatment-related services received prior to the intervention (e.g., consultations), the intervention itself, and the management of complications.

All estimates of resource utilization and cost were made on a per patient basis for Ontario and Quebec. No discounting or inflation adjustment was necessary because the entire additional course of treatment for either intervention does not commonly last beyond 1 year. Costs were reported in 1998 Canadian dollars.

Resource costs

To cost outpatient resources, including those involved in managing either surgical complications after hospital discharge, or complications following collagen treatment, two teaching hospitals (one in Toronto; one in Montreal) and 10 medical equipment manufacturers provided costs for lab tests and disposable equipment. Medical personnel costs came from physician fee schedules and nurses'/technicians' wages and benefits charts. Outpatient drug costs came from a randomly selected sample of three Montreal pharmacies. The analysis included only that fraction of drug costs reimbursed by Ontario and Quebec medicare programs. The portion of drug costs reimbursed by private insurance companies, or covered by patients themselves ('out-of-pocket' costs), was not included. Four urologists (two Ontario-based, two Quebec-based) provided cost data for collagen (e.g., cost of an injection kit).

Two teaching hospital databases (one in Ottawa; one in Montreal) generated cost data for an average inpatient admission for surgery. These data pertained to: radiology and laboratory, pharmacy, nursing, and operating room. The hospital databases contained the costs of managing surgical complications that occurred before patient discharge (e.g., intraoperative complications or those associated with the anesthesia).

Some resources related to inpatient room and board (i.e., meals, napkins, and laundry) were included in the analysis to account for the additional costs of a hospital stay for surgery. Per diem room and board costs were calculated using unit costs from teaching hospitals in Toronto and Montreal.

Decision analysis

A decision-tree Figure 1 was constructed to conduct three cost-effectiveness analyses for each province (i.e., a separate analysis for collagen and each of the following three surgical categories – retropubic suspension, transvaginal suspension, and sling procedure[1]). The reported results for each analysis included an average cost of treatment and an incremental cost-effectiveness ratio (ICER). The ICER represents the cost for each additional patient who is successfully treated with the more effective intervention.

The decision-tree is applicable to female SUI patients whose initial treatment with surgery failed, provided they are eligible to receive either surgery or collagen as a second intervention. The tree begins with a square 'decision node,' where a hypothetical patient elects surgical or collagen injection therapy. For each intervention, the branch from the decision node leads to a round 'chance node' and to two more branches representing the possibility that the treatment either succeeds or fails to cure the patient. The remaining chance nodes and branches represent the probability of complications from treatment (for surgery, complications that occur after hospital discharge; for collagen, all complications from treatment). The

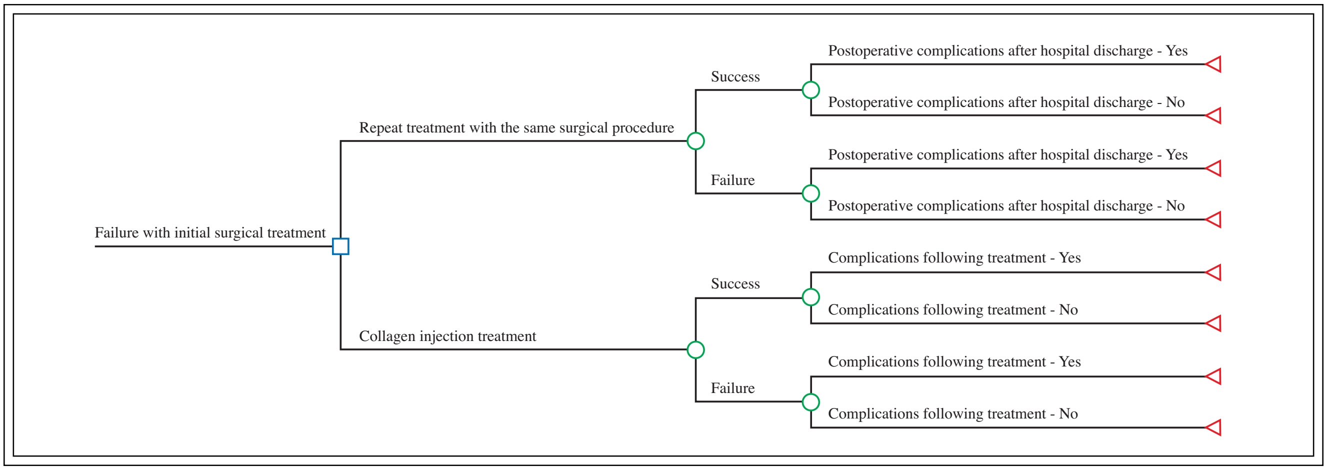

Figure 1. Decision-tree for the cost-effectiveness analysis of surgery versus collagen injection to treat female stress urinary incontinence after the failure of initial surgical treatment.

decision-tree does not apply to initial treatment, nor does it consider patients who go on to receive a third treatment.

The measure of effectiveness was 'cure' (i.e., no leakage during follow-up), either at 1 year after the second surgery or at 1 year after receiving the first collagen injection. It was assumed patients would not receive a third treatment until 1 year had past since the second attempt at therapy. 'Cure' was chosen because it appeared less ambiguous than an outcome including both 'cured' and 'improved' patients.

Probabilities representing 'cure' were included in the decision-tree. These probabilities, and probabilities for the occurrence of complications, were obtained from three possible sources ranked in the following order of preference: (a) summary articles (e.g., meta-analyses, review articles); (b) studies with at least 90 subjects; and (c) expert opinion (which was elicited via physician survey[12] – details available from authors on request). Lower ranked sources were consulted only in the absence of usable data from higher ranked sources.

The probabilities of success for the three surgical categories came from Leach et al.[1] Surgical complications after hospital discharge, and associated probabilities of occurrence, were drawn from five sources: Riggs[13] and Wang[14] (retropubic and transvaginal suspension); Spencer et al.[15] (retropubic suspension); and Cross et al.,[16] Chaikin et al.,[17] and Chan et al.[18] (sling procedures).

For collagen, the probability of success came from the physician survey. Complications from collagen, and their probabilities of occurrence, were obtained from Winters and Appell[19,20] and the CR Bard Company.[21]

To keep the decision-tree compact and manageable, complications were grouped together, by treatment, for inclusion into the model. Therefore, for any particular treatment, the probability assigned to the complications branch was the sum of the individual probabilities of all the complications associated with that treatment. Likewise, the cost figure assigned to the branch was the aggregate cost of treating all the individual complications. This approach was used before in a medical study employing a decision-tree.[22]

To allow for the calculation of ICERs, cost-effectiveness analysis requires that a numerical value representing treatment outcome be assigned to each triangular end node in the decision-tree. Therefore, outcomes at end nodes preceded by branches labeled 'success' were assigned a value of '1' to represent a patient who was successfully cured, while end nodes preceded by branches labeled 'failure' were assigned a value of '0.'

Base case and sensitivity analyses

Two sets of analyses were conducted for each of the three treatment comparisons: (a) base case and (b) sensitivity. The base case analysis used the following data: (a) point estimate probabilities of success/failure and occurrence of complications and (b) cost estimates calculated according to the methodology outlined in the section 'resource costs.' Since the mean number of collagen injections over a single course of treatment (within a time-frame of 1 year after receiving the first injection) differs between successfully and unsuccessfully treated patients,[4,5] it was assumed for the base case that there would be a mean of two injections in total for collagen successes and a mean of four injections in total for collagen failures. For surgery, it was assumed that the resources consumed during a procedure did not vary in accordance with treatment outcome.

The following sensitivity analyses were performed: (a) one-way sensitivity analysis varying the probability of success for each treatment, everything else held constant; (b) one-way sensitivity analysis varying the complication rate for each treatment, everything else held constant; (c) one-way sensitivity analysis assuming a one-day length of stay in hospital for surgery, everything else held constant (room and board were calculated for 1 day and inpatient resource costs from the hospital databases were pro rated for 1 day using the given lengths of stay in Table 3); and (d) one-way sensitivity analysis varying the mean number of collagen injections, everything else held constant.

The probability ranges for surgical cure, which were used in the sensitivity analyses, were obtained from Weber and Walters,[2] who constructed a decision-tree that included surgical treatment for SUI patients in whom initial surgery failed. The range for collagen was obtained from two review articles.[23,24] For all surgery and collagen complications, a range of ±10% was thought to be large enough to encompass the uncertainty in the cumulative point estimates adopted for the base case analyses.

Table 1 shows the success (cure) and complication probabilities, and side-effects, assigned to the branches of the decision-tree for each of the treatment comparisons. These probabilities were used to fold back the decision-tree.

TABLE 1. **Probabilities for the decision-tree**

Treatment	Branch	Probability (Point estimate/range)
Retropubic suspension	Success	.84/.62-.97
	Failure	1-Probability of success
	Postoperative complications after hospital discharge – yes (includes: new onset urge incontinence, superficial infection, seroma, hematoma, urinary tract infection, urinary retention, other low incidence complications[13])	.34/.24-.44
	Postoperative complications after hospital discharge - no	1-Probability of complications
Transvaginal suspension	Success	.79/.62-.97
	Failure	1- Probability of success
	Postoperative complications after hospital discharge – yes (includes: new onset urge incontinence, vaginal granulation, persistent cystocele requiring repair, suture abscess, chronic suprapubic pain, urinary tract infection, urinary retention, other low incidence complications[13])	.56/.46-.66
	Postoperative complications after hospital discharge – no	1-Probability of complications
Sling procedure	Success	.82/.62-.97
	Failure	1-Probability of success
	Postoperative complications after hospital discharge – yes (includes: urinary tract infection, de novo urinary urgency, persistent urge incontinence, urinary retention)	.29/.19-.39
	Postoperative complications after hospital discharge - no	1-Probability of complications
Collagen injection	Success	.53/.40-.60
	Failure	1- Probability of success
	Postoperative complications after hospital discharge – yes (includes: urinary retention, urinary tract infection, hematuria, hematoma formation at injection site, pain at injection site, urinary urgency, bladder spasms, vaginitis)	.20/.10-.30
	Postoperative complications after hospital discharge – no	1-Probability of complications

Data 3.0 software (TreeAge Software, Inc., Williamstown, MA) was used for all analyses.

Results

Table 2 lists the resources that were costed. Tables 3 and 4 list the estimated costs per patient of treating SUI with either surgery or collagen. Costs across provinces are not the same because of differences in: physician fees and nurses' wages; lengths of hospital stay after surgery; the numbers of patients contributing information to the hospital databases; and levels of publicly-funded drug cost reimbursement. Table 5 provides the costs of managing complications from treatment.

Cost-effectiveness – Ontario

In the three base case analyses Table 6, the ICERs were larger in magnitude when the differences between the average costs of surgery and collagen were greater. Since surgery costs more than collagen, but is also more successful Tables 1, 3, 4, the cost for each additional patient cured by surgery relative to collagen (i.e., the incremental ratio) is higher for more expensive surgical interventions.

Sensitivity analyses varying the probabilities of success did affect the results. For retropubic suspension, probabilities between .62-.65 produced an ICER of approximately $6384. In the case of transvaginal suspension, a success probability of .62 led to an ICER of $15 101, and any probability below .80 gave transvaginal suspension the highest ICER when all of the probabilities for the other treatments remained constant. Turning to sling procedure, a success probability of .62 generated an ICER of $22 299, and probabilities below .92 ensured that this intervention would remain the treatment with the highest average cost. Varying the success probability for collagen, and the complication probabilities for all interventions, did not materially impact the results.

A striking impact on the base case results was seen when surgical costs were recalculated assuming a 1 day length of stay in hospital, instead of the lengths reported in Table 3. In all three comparisons, the cost of surgery was reduced to a point where it was lower than the cost of collagen. Since all of the surgeries were also more successful, collagen was 'dominated' in each comparison. A dominated intervention is both less successful, and more costly, than its comparator.

Varying the number of collagen injections had a material impact on the results of the comparison with retropubic suspension. Assuming collagen patients who were cured received a mean of two injections, while failures received a mean of five injections, the ICER for retropubic suspension dropped to $912. At three injections (cure) and four injections (failure), the ICER was $788; at three and five injections respectively, collagen was dominated by retropubic suspension. ICERs for transvaginal suspension were reduced in magnitude at these same combinations of injections: $4062, $3914, and $2825 respectively. Sling procedure was least sensitive to varying the number of injections, with recomputed ICERs of $5839, $5705, and $4730 respectively.

Cost-effectiveness – Quebec

In the three comparisons of the base case for Quebec Table 7, the ICERs were also larger in magnitude when differences in average cost between surgery and collagen were greater. Compared to Ontario, though, the ICERs were smaller in magnitude.

Sensitivity analyses on the probabilities of success and occurrence of complications produced few changes to the base case results. For retropubic suspension, the ICER increased to between $4884 and $8769 when the probability of success (cure) ranged from .62 to .69. For transvaginal suspension, the ICER increased to a high of $8050 at a success probability of .62. Varying any of the probabilities for sling procedure and collagen injection did not materially affect the base case results.

Reducing the length of hospital stay to one day for all three surgical categories produced a large change in results relative to the base case. Collagen was dominated by each surgical category, as in Ontario.

Increasing the number of collagen injections also had a material impact on the results. ICERs decreased in magnitude as the use of additional material made collagen become more expensive relative to surgery. At a mean of two injections for treatment successes and five for failures, ICERs were: retropubic suspension - $1670; transvaginal suspension - $2010; sling procedure - $495. At three and four injections respectively, ICERs were: retropubic suspension - $1555; transvaginal suspension - $1874; sling procedure - $372. At three and five injections respectively: retropubic suspension - $720; transvaginal suspension - $876; sling procedure – collagen was dominated.

TABLE 2. **Resources costed for economic assessment**

Resource category	**Treatment applicability**	**Includes**
Hospital consultations	Surgery and collagen	Pre- and post-treatment examinations in a hospital
Professional services	Surgery and collagen	Surgeon, anesthesiologist, surgical assistant and radiologist fees for services rendered
Miscellaneous investigations	Surgery and collagen	Lab tests, x-rays, urodynamic assessments, other medical tests
Drugs/anesthesia	Surgery and collagen	Prescribed medications for treatment and complications management; anesthesia for surgery and collagen
Disposable equipment	Surgery and collagen	Items used for performing surgery or collagen injection; items used to treat complications or conduct miscellaneous investigations
Nurse/technician services	Surgery and collagen	Wages and benefits for services rendered in the treatment of stress urinary incontinence and related complications
Complications Management (Surgery: postoperative complications after hospital discharge; Collagen injection: all complications)	Surgery and Collagen	Cost of treating complications (professional fees, equipment, medical tests, nurse/technician wages and benefits, etc.)
Room and Board*	Surgery	Supplies, food and laundry
Hospitalized complications management*	Surgery	Cost of treating hospitalized complications (equipment, medical tests nurse/technician wages and benefits, etc.)
Skin Test*	Collagen	Skin test kit and nurses' wages and benefits

OHIP = Ontario Hospital Insurance Plan
RAMQ = Régie de l'assurance-maladie du Québec (Quebec Health Insurance Board)
'*' = Resources that are not used to manage either postoperative complications after hospital discharge (surgery) or all collagen complications
Hospital databases include inpatient costs for radiology and laboratory (all direct costs for tests, exams, supplies, and non-physician personnel), pharmacy (drug costs), post-operative nursing, and the operating room (nursing and anesthesiology technician's time, anesthesia products, and all surgical supplies) – the databases do not include physician fees

Sources for resource Utilization and cost data
Discussions with physicians, nurses' wages and benefits
Discussions with physicians, provincial medicare reimbursement schedules (OHIP, RAMQ)
Discussions with physicians, disposable equipment costs, nurse/technician wages and benefits
Discussions with physicians and consultations with pharmacies/provincial drug formularies for postoperative complications after hospital discharge (surgery) and all collagen complications - Hospital databases for items consumed during a hospital admission for surgery
Discussions with physicians and equipment purchase prices from hospitals and supply companies for postoperative complications after hospital discharge (surgery) and collagen - Hospital databases for items consumed during a surgical admission
Hospital databases for surgical hospital admissions - Wage and benefit schedules for other activities, and time spent engaged in those activities
All items in table except for those marked with an '*'
McGill University Health Center (Montreal, QC) and University Health Network (Toronto, ON) finance and accounting departments - Hospital databases for length of stay
Hospital databases
Discussions with physicians and nurses' wages and benefits

TABLE 3. **Estimated cost per patient of treating stress urinary incontinence with surgery**

Treatment	**Province**	**Length of stay (days)**	**Cost ($)**
Retropubic suspension	Ontario	3.16	2915
	Quebec	5.11	3169
Transvaginal suspension	Ontario	3.67	3367
	Quebec	5.40	2975
Sling procedure	Ontario	4.66	4609
	Quebec	4.67	3075

Note = Data for length of stay were obtained from the hospital databases (see legend – Table 2)

TABLE 4. **Estimated cost per patient of treating stress urinary incontinence with collagen injections**

Treatment outcome	**Mean number of injections (base case)**	**Province**	**Cost ($)**
Success (cure)	2	Ontario	1916
		Quebec	1919
Failure	4	Ontario	3393
		Quebec	3472

TABLE 5. **Aggregated costs of managing complications from treating stress urinary incontinence**

Treatment	**Province**	**Cost ($)**
Retropubic suspension	Ontario	1013
	Quebec	951
Transvaginal suspension	Ontario	1178
	Quebec	1080
Sling procedure	Ontario	165
	Quebec	148
Collagen injection	Ontario	439
	Quebec	362

Surgery = Costs are for complications occurring after hospital discharge. 'Pre-discharge' complications are included in the hospital databases (see legend – Table 2)
Sling procedure = Most complications occur before hospital discharge
Collagen = All costs to manage all complications are included in the table

Discussion

Collagen had the lowest average cost per patient for all base case comparisons.

Data suggesting potential cost advantages for collagen have been reported in other studies. Brown et al.[25] compared the costs of collagen and surgery (i.e., placement of an artificial genitourinary sphincter) in the management of post-radical prostatectomy urinary incontinence. Hospital charge data from the Mayo Clinic were used to estimate average per patient Medicare and non-Medicare costs for one collagen injection. Estimates (in United States dollars) were: (1) Medicare $4300 (range: $3900 to $4700); (2) non-Medicare $5625 (range: $5150 to $6100). The mean cost per patient (Medicare) of treatment with collagen,

TABLE 6. **Cost-effectiveness analysis base case results for Ontario**

Treatment comparison	Treatment	Average cost ($)	Incremental cost-effectiveness ratio ($)
Retropubic suspension	Retropubic suspension	3257	
Versus			
Collagen injection	Collagen injection	2695	
			1824
Transvaginal suspension	Transvaginal suspension	4024	
Versus			
Collagen injection	Collagen injection	2695	
			5151
Sling procedure	Sling procedure	4657	
Versus			
Collagen injection	Collagen injection	2695	
			6814

Incremental cost-effectiveness ratio = Cost for each additional patient cured by the intervention with the higher probability of success (cure) – i.e., surgery in all cases (Table 1 – point estimate probabilities for all surgical categories are greater than the estimate for collagen)

TABLE 7. **Cost-effectiveness analysis base case results for Quebec**

Treatment comparison	Treatment	Average cost ($)	Incremental cost-effectiveness ratio ($)
Retropubic suspension	Retropubic suspension	3490	
Versus			
Collagen injection	Collagen injection	2718	
			2505
Transvaginal suspension	Transvaginal suspension	3494	
Versus			
Collagen injection	Collagen injection	2718	
			3008
Sling procedure	Sling procedure	3118	
Versus			
Collagen injection	Collagen injection	2718	
			1388

Incremental cost-effectiveness ratio = Cost for each additional patient cured by the intervention with the higher probability of success (cure) – i.e., surgery in all cases (Table 1 – point estimate probabilities for all surgical categories are greater than the estimate for collagen) assuming a total of four injections over 10 years, was $17 200. The mean cost per patient (Medicare) of sphincter replacement over ten years ranged from $15 400 to $34 599. Brown et al. did not discount costs, nor did they examine efficacy data or female SUI.

Berman and Kreder[26] compared 14 women with intrinsic sphincter deficiency who underwent fascia lata sling cystourethropexy to another 14 age-matched individuals who received collagen injections. The authors consulted patient charts and billing statements from their hospital to derive a mean cost (in United States dollars) of $10 381 (standard deviation $1449) for the sling and $4996 (standard deviation $885) for collagen. After mean follow-up of 14.9 months (range: 10 to 22) for sling patients and 21.3 months (range: 7 to 29) for collagen patients, success rates ("total continence") were 71.4% (surgery) and 26.7% (collagen). Berman and Kreder concluded that the sling might be more cost-effective because of its higher success rate, but an incremental cost-effectiveness ratio comparing the sling with collagen was not provided.

The average cost per patient of treating SUI with either surgery or collagen in this study Tables 3 and 4 was lower than in both Brown et al.[25] and Berman and Kreder[26] because health care resources are often more expensive in the United States than in Canada. Also, charge data, which inflate the economic costs of resources, were used in the earlier publications. Still, the data in this and the earlier studies suggest surgery is more costly than collagen, at least in terms of base case patients.

This study differed from the earlier analyses in five ways: (1) it was Canadian-based; (2) ICERs were provided; (3) data were drawn from a variety of institutions to enhance generalizability; (4) more than one type of surgery was considered; and (5) applicability was to patients who were not successfully treated with initial surgery.

The ICERs for the base case Tables 6 and 7 suggested that the health care systems in Ontario and Quebec would both incur a cost for each additional patient that was successfully treated with any of the surgeries. For example, Table 6 displays the ICER '1824' for retropubic suspension and collagen in Ontario. Since the estimated probability of success for retropubic suspension is greater than the same probability for collagen Table 1, and the expected costs are $3257 and $2695 respectively, each additional patient who is successfully treated with retropubic suspension will cost the health care system an additional $1824 compared to collagen. If $1824 is an acceptable price to pay for an additional success with surgery, then all surgeries with ratios at, or below, $1824 would be cost-effective. If $1824 is not considered worth paying, then collagen would be cost-effective compared to the surgeries at or above this cost. Note that these costs would be on top of whatever other costs were already incurred during the first round of surgical treatment. Deciding upon the acceptable price to pay for a second course of therapy is a matter for discussion and consensus among patients, clinicians, and policy makers.

Sensitivity analyses suggested that some of the ICERs would increase in magnitude if the success probabilities of a second surgery after initial failure were between approximately .62 and .65. Conversely, the ICERs would decrease in all cases if the mean number of collagen injections were to increase. Only in the case of very short lengths of hospital stay after surgery (i.e., 1 day) would conclusions about the cost-effectiveness of treatment be relatively straightforward, as all three surgical categories would then be less costly and more successful than collagen.

The results of this study were based on data drawn largely from teaching hospitals in two Canadian provinces. Consequently, care must be taken when generalizing these results to other types of hospitals or health care settings. Within Canada, costs in teaching hospitals may differ from costs in other types of hospitals, but if the ordering of these costs is comparable, then generalizability is possible. For example, if the cost in a teaching hospital of curing an average patient with two collagen injections is less than the cost of achieving the same result with any type of surgery, and this is also the case in rural or urban community hospitals, then there is potential for generalizability. The exact dollar figures may differ, but the relationship between the treatments remains the same. If this is also the case at the health care system level, then the study's results could be generalized to the other provinces. However, due to differences between health care systems in Canada and other countries (e.g., funding arrangements, extent of medical coverage, cost attribution and billing), extreme caution should be used before generalizing this study's results to jurisdictions outside Canada.

A strength of this study was that cost data were obtained from numerous sources, rather than from just one institution. This reduced the extent to which costing peculiarities from any one data source could bias the results. For example, some hospitals may only report an average daily cost of inpatient stay, which includes data from mildly-ill to the sickest of patients. Applied to SUI, such data could have overestimated the costs associated with a hospital stay for surgery.

Another strength of this study was its inclusion of three surgical therapies. Since collagen has been shown to have at least some success in patients who are eligible to receive these surgeries, a more comprehensive economic assessment resulted from their inclusion.

A limitation of this study was the lack of consideration of what may happen to patients who fail the second course of treatment and go on to a third round of therapy. Given that collagen's probability of curing a patient, and durability over time, are less than surgery's,[26] the downstream costs to the health care system of treating patients with collagen after initial surgical failure could be higher than treating with surgery if many individuals in whom the injections fail seek further treatment.

A second limitation was the lack of data on patient quality of life. If patients are satisfied with reduced urine leakage, then the probability of success for one or both treatments could be higher relative to when success is measured by complete continence.

A third limitation was the lack of information on the learning curve for collagen, which is still a relatively new procedure. If the costs of treating patients with collagen decrease over time as experience allows clinicians to use less material and take less time to perform the injection procedure,[23] then the cost of the injectable may decrease relative to surgery.

Conclusions

From the health care system perspectives in Ontario and Quebec, collagen may be a cost-effective option for treating SUI after initial surgical failure when the number of injections is kept to a minimum and hospital stays after surgery are relatively lengthy. If the length of stay for surgery is short (i.e., 1 day), then collagen would be a dominated strategy and surgery would be the most cost-effective option. □

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