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SINGLE INCISION MINI-SLINGS VERSUS STANDARD MID-URETHRAL SLINGS IN SURGICAL MANAGEMENT OF FEMALE STRESS URINARY INCONTINENCE: A COST-EFFECTIVENESS ANALYSIS ALONGSIDE A RANDOMISED CONTROLLED TRIAL.

Hypothesis / aims of study

To assess the cost, quality of life and cost-effectiveness of "Single Incision Mini-Slings" (SIMS- Ajust©) compared to "Standard Mid-Urethral Slings" (SMUS): tension-free vaginal tapes TVT™ Obturator system in the management of female stress urinary incontinence (SUI).

Study design, materials and methods

A cost-effectiveness analysis alongside a multi-centred prospective randomised trial in 6 UK centres between October-2009 and October-2010; 137 women randomised to either adjustable SIMS- Ajust© (C. R. Bard, Inc., New Jersey, and USA; n=69), performed under Local Anaesthesia (LA) as an opt-out policy, or TVT™ Obturator system (Ethicon Inc., Somerville, USA; n=68) performed under general anaesthesia (GA). Detailed clinical data are presented in a parallel abstract [1]. The primary health economic outcome for the study was incremental cost-effectiveness ratio (ICER), calculated as [(Cost of SIMS – cost of SMUS) / (QALY for SIMS – QALY for SMUS)]. The perspective was the UK National Health Services (NHS) and follow-up was 12 months. Resource items contributing to the cost of each intervention included staff time (surgeon, anaesthetist, anaesthetic nurse and theatre nurse time apportioned per minute of patient time spent in theatre); anaesthetic drugs for GA and LA; and surgical kits. Costs were applied to resource use estimates as follows: staff resource use (the appropriate staff grade from PSSRU, unit costs for health and social care), anaesthetic costs (British National Formulary (BNF)) and the price of the surgical kits (manufacturer list prices). These costs were summed to calculate total intervention costs. Contacts with health services over follow up were collected through patient administered questionnaires at 12 months. Resource use data included re-operations, secondary (e.g. all contacts with hospitals) and primary (e.g general practitioner) care services as well as prescription medications. Costs were sourced from: NHS reference costs (cost of re-operations), ISD Scotland (cost of secondary care contacts), PSSRU (primary care contacts) and BNF (drug costs). Costs were applied to resource use data and added to intervention costs to develop a total cost to the health services. Quality of life data were collected at baseline, 4 and 12 months of follow-up using a condition specific tool, the Kings Health Questionnaire (KHQ) version 7. An algorithm was used to transform these data into a utility index measure; namely quality adjusted life years (QALY) [2]. Mean cost and QALY data were compared across trial arms using standard linear regression models, adjusting for baseline covariates (e.g. age, mixed / stress UI, baseline KHQ score). Bootstrapped confidence intervals (CI) based on 1,000 repetitions were used to account for the non-normality of the cost data. The probability of the SIMS/SMUS being cost saving or cost-effective is calculated using the bootstrapped cost and QALY pairs. Sensitivity analyses explored the impact of completing all SIMS procedures under LA. Multiple imputation methods using iterative chained equations tested the impact of missing data on our results. Analyses were completed in Stata 11™ & SPSS 19™ software.

Results

Complete cost and QALY outcome data were available for 124/137 (91%) of trial respondents; 69/69 (100%) randomised to SIMS N=56 / 69 (81%) of cases randomised to SMUS at one year follow-up. The current list price for SIMS, Ajust© is £612.22 and for TVT™ Obturator system is £550 per unit. The interventions (based on GA/LA received) cost an average of £969 and £1,116 per trial participant for SIMS and SMUS respectively. The SIMS intervention was less costly to deliver. Total costs to the health services (intervention + follow-up use of health services) were on average, lower for SIMS, although differences were not statistically significant. Full details are presented in table 1. Although the base estimate suggests a negative QALY, differences were almost negligible in magnitude. Results however, should be interpreted with caution, and in the context of the variation in the confidence interval. The base case ICER is £42,820 cost savings per QALY sacrificed. Assuming that the interventions are equivalent (in terms of QALYs), there is an 86% chance that the SIMS intervention is cost saving based on our data. SIMS intervention was significantly less costly under a sensitivity analysis where all SIMS procedures were performed under LA, leading to a cost saving of £80,500 per QALY lost. Results and conclusions were not sensitive to missing data, despite these data being unevenly distributed across trial arms.

Table 1: Base Case Cost, QALY and cost-effectiveness results.

	Unit costs	**Source**	**Resource use, Mean (SD)**		**Total costs (£); mean (SD)****		**Mean cost difference (£) (95% CI)***
			SIMS (N=68)	TVT-O (N=56)	SIMS (N=68)	TVT-O (N=56)	
Intervention cost			-	-	969	1,116	-139.48 (-201 to -78)
Time on Ward (Hours)	£20.55	ISD	3.75 (1.8)	4.36 (2.27)	77 (37)	90 (47)	-7.69 (-22 to 7)
Re-operation, n (%)	£1,222	NHS	5 (7.4%)	2 (3.6%)	90 (321)	44 (229)	-14.73 (-62 to 32)
Other hospital stay (nights)	£450	ISD	0.03 (0.24)	0 (0)	13 (109)	0 (0)	+11.88 (-13 to 37)
Outpatient, mean (SD)	£144	ISD	0.5 (0.84)	0.63 (0.91)	72 (121)	90 (130)	-4.48 (-60 to 51)
GP, mean (SD)	£36	PSSRU	0.15 (0.70)	0.20 (0.64)	5(25)	7 (23)	-0.56 (-11 to 10)
Practice nurse, mean (SD)	£13.18	PSSRU	0.04 (0.27)	0.04 (0.19)	0.6 (3.6)	0.5 (2.5)	-0.21 (-1.16 to 0.73)
district nurse, mean (SD)	£73	PSSRU	0.01 (0.27)	0(0)	1 (9)	0 (0)	+0.47 (-0.88 to 1.82)
Physiotherapist, mean (SD)	£22.09	PSSRU	0.10 (0.74)	0.13 (0.94)	2(16)	3(21)	+0.28 (-5.60 to 6.17)

Total Medication costs	BNF	7 (10%)	9 (16.1%)	35(103)	54 (125)	-21.79 (-65 to 22)
Total costs:				**1,265 (460)**	**1,403 (368)**	**-85.64 (-254 to 82)**
Total QALY:				**0.9775 (0.0196)**	**0.9804 (0.0151)**	**-0.002 (-0.007 to 0.003)**
ICER (Base Case)						**£42,820**
ICER (all SIMS get LA)						**£80,500**
ICER (exploratory data imputation)						**£37,520**

*Mean cost & QALYs differences adjusted for baseline covariates of *age, BMI score, Smoking status, Previous HRT, PFMT, diagnosis of stress or mixed UI, antimuscarinics at baseline, duloxetine at base line and baseline total KHQ.*
**rounded to the nearest whole £ sterling*

Interpretation of results

The SIMS intervention is less costly to deliver (driven by reduced resource requirements for a procedure under local anaesthetic). Our results suggest that this may translate into overall cost savings to the health services provider, without any significant loss in quality of life (QALYs). This is in part dependant on what proportion of procedures are implemented under LA. The incremental cost-effectiveness ratio of £42,820 per QALY difference suggests that if SMUS: TVT™ Obturator system was the accepted standard of care, the health services could save £42,820 at the expense of 1 QALY by adopting SIMS. If all SIMS patients received the operation under LA, cost savings per QALY sacrificed would increase to £80,500. The results are sensitive to the method of anaesthesia used to deliver the SIMS intervention, but were not greatly impacted by missing data. These results are not conclusive and should be interpreted with caution as there are some concerns in relation to the method of QALY calculation. Best health economic practice suggests that the ideal instrument to calculate QALYs is the EQ-5D or the SF-6D. Our estimates are derived from the KHQ, via an algorithm. This creates noise and uncertainty in the estimates. QALYs derived from the KHQ have been shown to be a poor predictor of quality adjusted life years and may reduce the sensitivity of the instrument to detect a meaningful QALY difference across the arms of the trial. An alternative reason for the lack of difference may be that the trial was not powered to detect cost or QALY differences. It is not clear, whether our QALY estimates are an under or overestimate of the true QALY difference between arms and so a larger trial would be required to provide a definitive answer, addressing the highlighted methodological uncertainties. The relationship between EQ-5D and KHQ requires further investigation. Return of completed questionnaires was high, however further investigation is required to determine why there was an imbalance of missing data across trial arms.

Concluding message

Our results indicate that the SIMS operation is less costly to perform than SMUS and may be cost saving in terms of total NHS costs. This potential cost saving is compared with negligible quality of life decrements. A future definitive trial is needed to confirm the cost savings reported here and further investigate quality of life implications, whilst addressing the highlighted methodological uncertainties. Future work should also include a composite of measures of economic evaluation (cost-benefit analysis, cost-effectiveness analysis and cost-utility analysis). Consideration should also be given to patient preferences for mode of anaesthesias, pain profile, quality of care and other applicable attributes, through the conduct of a discrete choice experiment. Further work should also explicitly aim to test existing and develop new mapping algorithms between the KHQ and EQ-5D measures of quality of life. This will inform not only the comparison of these interventions but also all trials in urinary incontinence where the KHQ is the primary measure of quality of life.

References

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Disclosures

Funding: The study – SIMS (RCT) was funded by a Henry Smith Charity. Dr. Abdel-fattah is a consultant for Bard, AMS, Pfizer and Astellas. Dr. Abdel Fattah and Dr. Mostafa have received travel grants from different pharmaceutical companies to attend medical conferences **Clinical Trial:** Yes **Public Registry:** Yes **Registration Number:** The study was approved by the North of Scotland Ethical committee and the protocol was registered on the public domain www.ClinicalTrials.gov; Regestration Number: NCT0123045 **RCT:** Yes **Subjects:** HUMAN **Ethics Committee:** North of Scotland ethical committee **Helsinki:** Yes **Informed Consent:** Yes