

Diagnostic Accuracy of Intraoperative Void Score in Predicting Catheter Free Status in Patients Undergoing Transurethral Resection of the Prostate (TURP)

Raja Kamran Akhtar¹, Saeed Abidi², Harris Hassan Qureshi³, Riaz Hussain Laghari⁴, Syed Adibul Hassan Rizvi⁵

¹⁻⁵Sindh Institute of Urology and Transplantation, Karachi

ABSTRACT

Objective: To analyze the accuracy of diagnosis and inter-observer reliability of the intraoperative void score in predicting the catheter-free status after TURP.

Methodology: The prospective study on diagnostic accuracy was a diagnostic accuracy study that was carried out in the Department of Urology, Sindh Institute of Urology and Transplantation, during a period of six months. One hundred and seventeen men aged ≥ 50 years with benign prostatic hyperplasia who received TURP were recruited through consecutive sampling. The intraoperative void score was measured right after the resection through the application of standardized suprapubic pressure (50 N) and the rating of the urinary stream. The scoring was done by two independent assessors. Success in the study was a trial without a catheter (TWOC) on days 3-5 post-operation and a post-void urine of less than 100 mL and no re-catheterization. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), overall accuracy, 95% confidence intervals, and Cohen's kappa were determined.

Results: Among 117 patients, 71 (60.7%) patients managed to have their catheter-free voiding, and 46 (39.3%) patients failed TWOC. The intraoperative void score was able to point out 58 true positives, 46 true negatives, 13 false negatives, and no false positives. The sensitivity was 81.7%; specificity, 100%; PPV, 100%; NPV, 78.0, and general diagnostic accuracy, 88.9%. Inter-rater reliability was high (0.81), which means that there was near-perfection.

Conclusion: Intraoperative void score is a very specific, reliable, and practical predictor of catheter-free voiding after TURP. Its simplicity to use and its good diagnostic capability justify its application in the routine perioperative assessment to inform the early postoperative management.

Keywords: Benign Prostatic Hyperplasia (BPH), Catheter-Free Voiding, Intraoperative Void Score, Transurethral Resection of the Prostate (TURP), Trial Without Catheter (TWOC)

Authors' Contribution:

^{1,2}Conception; ¹Literature research; ¹manuscript design and drafting; ^{3,4}Critical analysis and manuscript review; ⁵Data analysis; Manuscript Editing.

Correspondence:

Raja Kamran Akhtar
Email: rajakamran1994107@gmail.com

Article info:

Received: April 28, 2026
Accepted: June 10, 2026

Cite this article. Akhtar RK, Abidi S, Qureshi HH, Laghari RH, Rizvi SAH. Diagnostic Accuracy of Intraoperative Void Score in predicting catheter free status in patients undergoing Transurethral Resection of the Prostate (TURP). J Islamabad Med Dental Coll. 2026; 15(2): 199-205. DOI: <https://doi.org/10.35787/jimdc.v15i2.1598>

Funding Source: Nil
Conflict of interest: Nil

Introduction

The most frequently used operation on people who are diagnosed with benign prostatic hyperplasia is transurethral resection of prostate (TURP).¹ It is the endoscopic ablation of enlarged prostate tissue that

leads to obstruction of urinary outflow and is linked with much lower morbidity than open prostatectomy.² Although monopolar electro-resection has been the conventional choice of TURP, bipolar TURP is a new surgical approach to TURP

because it is linked with less blood loss, better visibility, and a lower incidence of TURP syndrome.^{3,4} Benign prostatic hyperplasia (BPH) is one of the most common conditions in aging men and the major cause of lower urinary tract symptoms (LUTS), which significantly affects the quality of life.⁵ The incidence of BPH rises with age as the disease can impact almost half of men above 60 years and even 80% of men above 80 years.^{6,7} Transurethral resection of the prostate (TURP) is still the gold standard intervention to offer surgical care to patients with moderate to severe LUTS that do not respond to conservative or pharmacological treatment.⁸ Postoperative outcome after TURP is variable, even though it is effective, especially in terms of successful catheter removal and normal voiding patterns.⁹

The conventional methods of assessing voiding include postoperative assessment by clinical evaluation, trial without catheter (TWOC), post-void residual urine (PVR), and uroflowmetry.¹⁰ It was found that the successful catheter-free voiding post-TURP is dependent on several variables, such as bladder function, detrusor contractility, and preoperative urinary retention.¹¹ Nevertheless, these tests are usually done during the postoperative period, which could slow down the process of clinical decision-making and increase the length of stay.¹²

Over the last few years, attempts have been made to determine intraoperative predictors of postoperative outcomes. Robinson et al. proposed the idea of the intraoperative void score, which is a straightforward and convenient approach to the prediction of catheter-free voiding after TURP.¹³ On the same note, other investigations that assessed perioperative predictors of TURP outcomes have focused on how patients at risk of postoperative urinary retention or unsuccessful catheter removal are identified early.¹⁴ Nevertheless, the majority of such studies are devoted to preoperative urodynamic parameters or postoperative studies and not to intraoperative predictive instruments.¹⁵

The intraoperative void score is promising because it is a fast and cheap procedure; however, its external validation is scarce.^{16,17} The varying patient characteristics, surgery methods, and perioperative care guidelines can affect its diagnostic outcomes in various groups of people and healthcare environments.¹⁸ Up to this point, there is a gap in locally conducted studies to determine the diagnostic accuracy of the intraoperative void score to predict successful catheter-free outcomes after TURP.

Hence, the proposed research was designed to determine the diagnostic validity of the intraoperative void score to predict catheter-free voiding after TURP in a tertiary care environment. This paper aimed to give evidence to support the clinical usefulness of this intraoperative assessment tool and how this tool could contribute to better postoperative management and decision-making.

Methodology

This study was a prospective diagnostic accuracy study, which was carried out in the Department of Urology at Sindh Institute of Urology and Transplantation (SIUT) in Karachi, a tertiary care facility. The experiment was conducted for six months with the permission of the institutional ethics committee. It started on September 01, 2025, and ended on February 28, 2026. The sample size was estimated using sensitivity (82) and specificity (100) of the intraoperative void score that had been previously reported, an estimated prevalence of benign prostatic hyperplasia (BPH) of 60, a 9 margin of error, and a 95% confidence level. The study needed 117 patients. A non-probability consecutive method of sampling was used to recruit participants. The study considered male patients aged 50 years and above, diagnosed with benign prostatic hyperplasia and who were to undergo transurethral resection of the prostate (TURP), and had the capacity to give informed consent. Patients who had a history of urethral stricture disease, neurogenic

bladder disorder, had undergone prostate surgery before, or had a known or suspected prostate malignancy were excluded. Patients were recruited to the study upon obtaining the consent of the ethical approval and written informed consent. The baseline demographic and clinical information (age, symptom severity, and medical history) was noted. Each of the patients had TURP as per the usual operation procedures. Intraoperative void score assessed by measuring the standardized suprapubic pressure that was 50 N, with a calibrated hand dynamometer.¹⁹ The resultant urinary stream was rated based on a scoring system set out. To achieve accuracy, two trained observers were used to conduct the assessment independently. In the event of a discrepancy, a consensus score was arrived at. A trial without a catheter (TWOC) conducted on postoperative days 3 to 5 was used to assess the postoperative outcome. The achievement of a catheter-free state was considered to be a volume of less than 100 mL of post-void residual urine as measured by ultrasound and without any re-catheterization. Failure was considered when the post-void residual volume is 100 mL or more, or because of the necessity to catheterize once again. This study was conducted at the Sindh Institute of Urology and Transplantation after obtaining the ethical approval form from the Institutional review board (IRB No. 559-2025)

Data Analysis: Statistical Package of the Social Sciences (SPSS) version 26.0 was used to analyze data. Mean standard deviation was used to represent the quantitative variables, and frequencies and percentages were used to represent the qualitative variables. Diagnostic accuracy of the intraoperative void score was assessed by determining sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and precision. An analysis was done using a 2x2 contingency table. All diagnostic parameters were calculated as 95 percent confidence intervals. Interobserver agreement between the two observers was determined using Cohen's kappa

statistic. The p-value of 0.05 or below was regarded as statistically significant.

Ethical Considerations : The study was started with the approval of the Institutional Review Board. Informed consent was received through written consent. The confidentiality of patients was ensured, and all the information was anonymized. The research was carried out in accordance with the principles of the Declaration of Helsinki.

Results

The study involved 117 patients who were undergoing Transurethral Resection of the Prostate (TURP). Follow-up was done to all patients, and the trial without a catheter (TWOC) on postoperative day 3-5 was used to assess catheter-free voiding status.

The table I. Shows the demographic characteristics of the subjects. The study subjects were men aged 50 years and above, which is in line with the epidemiology of benign prostatic hyperplasia.

Table I. Baseline Demographic Characteristics (n = 117)

Variable	Mean $\pm$ SD	Minimum	Maximum
Age (years)	67.4 $\pm$ 9.1	50	85

Table II. TWOC Outcomes and Contingency Analysis of Intraoperative Void Score

A. TWOC Outcome			
Outcome	Frequency	Percentage	
Successful catheter-free voiding	71	60.7%	
Failed TWOC	46	39.3%	
B. Contingency			
Intraoperative Void Score	Successful TWOC	Failed TWOC	Total
Positive	58 (TP)	0 (FP)	58
Negative	13 (FN)	46 (TN)	59
Total	71	46	117

Table III: Diagnostic Accuracy and Inter-Observer Reliability (with 95% CI)		
Parameter	Value %	95% Confidence Interval
Sensitivity	81.7	71% – 90%
Specificity	100	92% – 100%
Positive Predictive Value (PPV)	100	93% – 100%
Negative Predictive Value (NPV)	78.0	66% – 87%
Overall Accuracy	88.9	82% – 94%
Cohen's Kappa	0.81	70% - 90%

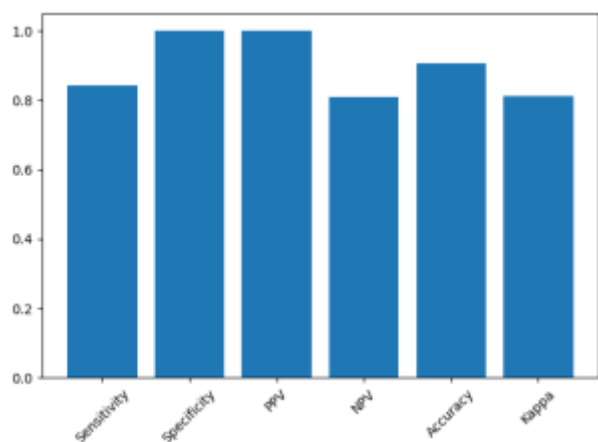


Figure 1. The comparative figures of diagnostic parameters with specificity

Seventy-one (60.7%) out of 117 patients had successfully performed catheter-free voiding, and 46 (39.3%) failed and required re-catheterization or PVR of 100 mL or above.

To determine the accuracy of the diagnosis, the intraoperative void score was compared with the TWOC outcome in **table II**.

The contingency table was used to calculate diagnostic indices. The statistic of Cohen's Kappa was used to determine agreement between the two independent assessors of the intraoperative void score. The intraoperative void score has shown that it has an excellent specificity and PPV (a positive test is a good predictor of successful catheter-free

voiding). Sensitivity was equally high, with a good performance in identifying the patients who could successfully void following their operations.

The table 3. shows that there is great reproducibility and reliability of intraoperative void score assessment.

Figure 1 bar chart shows the comparative figures of diagnostic parameters, with specificity and PPV having the highest values, with a good overall diagnostic performance.

In this diagnostic accuracy trial, 71 patients (60.7%) underwent TURP as a treatment of benign prostatic hyperplasia, 71 patients (60.7%), on trial without catheter (TWOC), and 46 (39.3%) failed. The score of intraoperative void compared to this reference standard showed good diagnostic performance. It identified correctly 58 true positives and 46 true negatives, no false positives, and 13 false negatives. The result of this was a sensitivity of 81.7, specificity of 100, positive predictive value of 100, negative predictive value of 78.0, and a total diagnostic accuracy of 88.9. Also, the two assessors had an excellent inter-observer agreement with the Cohen kappa of 0.81, which suggested near-perfect reliability. Taken together, these results indicate that intraoperative void score is a very specific, reliable, and clinically useful intraoperative predictor of successful catheter-free voiding after TURP.

Discussion

The paper is a prospective diagnostic accuracy study where the usefulness of the intraoperative void score as a real-time predictor of catheter-free status after Transurethral Resection of the Prostate due to benign prostatic hyperplasia was assessed. The results indicate that intraoperative void score has good specificity (100%), positive predictive value (100%), high sensitivity (81.7), and general diagnostic accuracy (88.9). In addition, the inter-observer agreement was nearly flawless (0.81), which serves to point out that the assessment is not

only diagnostically strong but also has a high degree of inter-observer reliability.

Conventionally, postoperative voiding success prediction during TURP is based on postoperative outcome measurement parameters, which include trial without catheter (TWOC), post-void residual urine, uroflowmetry, and preoperative urodynamic investigations.^{11,20} Although such measures are helpful, they are conducted during post-operative practice and, therefore, can delay clinical decisions, extend catheterization, and extend hospitalization. The idea of intraoperative predictors, consequently, fills an essential gap in the management of perioperative.²¹

The potential contribution of the intraoperative void score to better perioperative planning and patient counselling is another significant finding of the current investigation. Surgeons can make decisions about catheter duration, discharge planning, and postoperative monitoring because the assessment is done right after TURP and gives them early information about the likelihood of effective postoperative voiding. Early detection of individuals who have a good chance of successfully voiding without a catheter may save needless prolonged catheterization, lessen patient suffering, and save medical expenses related to prolonged hospital stays.²² Additionally, by enabling more precise expectations regarding postoperative recovery and voiding outcomes, integrating this straightforward intraoperative technology into standard surgical practice may improve communication between doctors and patients. Consequently, the intraoperative void score may support more effective and patient-centred postoperative care routes in addition to its diagnostic capabilities.²³

The current results are in line with the original study by Robinson that introduced the intraoperative void score and achieved high sensitivity and specificity to predict successful catheter removal post TURP.¹³ Such observations are externally validated by our study, in another group of patients and a healthcare environment, and increase the generalizability of

this tool.¹⁸ The superb specificity and PPV of the two studies indicate that when the intraoperative void score is positive, clinicians can be very certain that they are going to succeed in postoperative voiding.^{24,25}

The other studies that have measured predictors of TURP results have mostly concentrated on preoperative detrusor contractility, bladder compliance, or urodynamic parameters.^{26,27} These studies are informative but need specific equipment, experience, and extra expenditure.²⁶ In comparison, the intraoperative void score is easy, fast, economical, and does not need any advanced equipment, thus especially appropriate in resource-deficient environments.²⁸

The relatively low negative predictive value (78%), which was found in this study, shows that not all patients with a negative intraoperative void score achieve catheter-free voiding. This indicates that when a positive score is obtained, the score is very effective in predicting success, but when a negative, the score is to be taken with caution and subjected to normal postoperative examination. This property makes it a more useful rule-in test and not a rule-out test.

The large value of kappa (0.81) indicates that the scoring system used is objective and repeatable in case it is conducted by trained observers. It is a critical strength since it supports the fact that the intraoperative void score is not operator-specific and may be used in regular surgical practice with reliability.

All in all, this research piece is a good indication that the intraoperative void score can be used as an early decision-making instrument that may enable surgeons to predict the postoperative outcomes, manage the catheters more efficiently, and shorten the hospital duration.

Conclusion

Our findings suggest that the intraoperative void score has potential utility in predicting TWOC

outcomes after TURP. Despite encouraging diagnostic accuracy, external validation in larger and multicentre cohorts is necessary prior to routine clinical implementation.

Limitations

This study has some limitations, although its strengths are rather strong:

- The research was carried out in one tertiary care centre, and this might restrict extrapolation.
- The sample size, being statistically adequate to estimate diagnostic accuracy, is quite small.
- The covariates were not used to analyse factors like prostate size, duration of symptoms, and bladder functioning, and only the age and baseline characteristics were used.
- There was no long-term voiding function follow-up after the initial TWOC period.
- The intraoperative assessment as a standardized use of suprapubic pressure, and it is necessary to train it.

Recommendations

1. These findings should be further confirmed by multicentre studies, which need to have a larger sample.
2. The future studies must assess the correlation between intraoperative void score and preoperative urodynamic parameters.
3. Follow-up studies must be developed on a long-term basis in order to evaluate the long-term voiding results.
4. Intraoperative void score ought to be included in the normal operative procedures of TURP.
5. The assessment technique should be standardized with training modules to be created in order to support the method used by urologists.

References

1. Ditunno F, Manfredi C, Licari LC, Bologna E, Franco A, Pandolfo SD, et al. Benign prostatic hyperplasia surgery: A snapshot of trends, costs, and surgical retreatment rates in the USA. *European Urology* 2024;10(5):826-32.

2. Cornu JN, Herrmann T, Traxer O, Matlaga B. Prevention and management following complications from endourology procedures. *European urology focus*. 2016;2(1):49-59. <https://doi.org/10.1016/j.euf.2016.03.014>
3. Zou Z, Xu A, Zheng S, Chen B, Xu Y, Li H, et al. Dual-centre randomized-controlled trial comparing transurethral endoscopic enucleation of the prostate using diode laser vs. bipolar plasmakinetic for the treatment of LUTS secondary of benign prostate obstruction: 1-year follow-up results. *World journal of urology*. 2018;36(7):1117-26. <https://doi.org/10.1007/s00345-018-2229-3>
4. Omar MI, Lam TB, Alexander CE, Graham J, Mamoulakis C, Imamura M, et al. Systematic review and meta-analysis of the clinical effectiveness of bipolar compared with monopolar transurethral resection of the prostate (TURP). *BJU international*. 2014;113(1):24-35. <https://doi.org/10.1111/bju.12281>
5. Calogero AE, Burgio G, Condorelli RA, Cannarella R, La Vignera S. Epidemiology and risk factors of lower urinary tract symptoms/benign prostatic hyperplasia and erectile dysfunction. *The Aging Male*. 2019;22(1):12-9. <https://doi.org/10.1080/13685538.2018.1434772>
6. Xiong Y, Zhang Y, Li X, Qin F, Yuan J. The prevalence and associated factors of lower urinary tract symptoms suggestive of benign prostatic hyperplasia in aging males. *The Aging Male*. 2020;23(5):1432-9. <https://doi.org/10.1080/13685538.2020.1781806>
7. Launer BM, McVary KT, Riche WA, Lloyd GL. The rising worldwide impact of benign prostatic hyperplasia. *BJU international*. 2021;127(6):722-8. <https://doi.org/10.1111/bju.15286>
8. Foster HE, Barry MJ, Dahm P, Gandhi MC, Kaplan SA, Kohler TS, et al. Surgical management of lower urinary tract symptoms attributed to benign prostatic hyperplasia: AUA guideline. *The Journal of urology*. 2018;200(3):612-9. <https://doi.org/10.1016/j.juro.2018.05.048>
9. Pujari NR. Transurethral resection of prostate is still the gold standard for small to moderate sized prostates. *Integrative Medicine in Nephrology and Andrology*. 2016;3(2):68-9. <https://doi.org/10.4103/2394-2916.181223>
10. Eggemann C, Nobrega L. Postoperative Urinary Retention: A Call for Objective Assessment and Standardized Postoperative Protocols. *Cureus*. 2025;17(12). <https://doi.org/10.7759/cureus.99978>
11. Schembri B, Attard R, Micallef M, Mifsud N, Busuttill G. Preoperative factors affecting TURP postoperative outcomes. 2024. <https://www.um.edu.mt/library/oar/handle/123456789/125193>

12. Song SH, Chung Y, Ryu H, Lee JW, Lee S. Efficacy and Reliability of Mobile Uroflowmetry in Patients With Benign Prostatic Hyperplasia Undergoing Transurethral Resection: Prospective Multicenter Observational Pilot Validation Study. *Journal of Medical Internet Research*. 2025;27:e75313. <https://doi.org/10.2196/75313>
13. Robinson C, Hepburn A, Turner RM, Zarrabi AD. The role of intra-operative void score during transurethral resection of prostate as a marker of efficacy: a feasibility study. *ANZ Journal of Surgery*. 2022;92(6):1492-7. <https://doi.org/10.1111/ans.17664>
14. Tarcan T, Acar Ö, Malde S, Sinha S, Sahai A, Perrouin-Verbe MA, et al. Can we predict whether a man with acute or chronic urinary retention will void after bladder outflow resistance reduction surgery? *ICI-RS 2023. Neurourology and urodynamics*. 2024;43(6):1439-46. <https://doi.org/10.1111/ans.17664>
15. Lor KY, Soupashi M, Abdel-Fattah M, Mostafa A. Does pre-operative urodynamics lead to better outcomes in management of urinary incontinence in women? A linked systematic review and meta-analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2020;244:141-53. <https://doi.org/10.1016/j.ejogrb.2019.11.013>
16. Li W, Li X. Development of intraoperative assessment of margins in breast conserving surgery: a narrative review. *Gland Surgery*. 2022;11(1):258. <https://doi.org/10.21037/gs-21-652>
17. Alam IS, Steinberg I, Vermesh O, van den Berg NS, Rosenthal EL, van Dam GM, et al. Emerging intraoperative imaging modalities to improve surgical precision. *Molecular Imaging and Biology*. 2018;20(5):705-15. DOI:10.1007/s11307-018-1227-6
18. Liu Q, Wei J, Yang C, Wu L, Jiang C. Intraoperative B-line scores increase over time and are minimally affected by central venous pressure during transurethral resection of the prostate. *Scientific Reports*. 2026. <https://doi.org/10.1038/s41598-025-34114-z>
19. Mohr MN, Uhlig A, Strauß A, Leitsmann C, Ahyai SA, Trojan L, et al. Prospective evaluation of an intraoperative urodynamic stress test predicting urinary incontinence after robot-assisted laparoscopic radical prostatectomy. *Urology Annals*. 2023;15(2):166-73. https://doi.org/10.4103/ua.ua47_22
20. Kenyeres B, Helmecci A, Pytel Á. Efficacy of Transurethral Resection of the Prostate in Male Patients With Impaired Detrusor Contractile Function and Urinary Retention. *LUTS: Lower Urinary Tract Symptoms*. 2025;17(6):e70040. <https://doi.org/10.1111/luts.70040>
21. Kuo J, Chuang M, Jan H, Ho Y, Kao Y, Tsai K, et al. 9- Predicting Initial Trial Without Catheter Failure After Prostate Deobstruction Surgery: The Role of Preoperative Urodynamic Parameters. *Continence*. 2025;15:101933. <https://doi.org/10.1016/j.cont.2025.101933>
22. Chrouser K, Fowler KE, Mann JD, Quinn M, Ameling J, Hendren S, et al. Urinary retention evaluation and catheterization algorithm for adult inpatients. *JAMA Network Open*. 2024;7(7):e2422281. <https://doi.org/10.1001/jamanetworkopen.2024.22281>
23. Lopez BM, Lee BM, Miller MD, Ibrahim MM, Vanderah TW, Riegel AC. Postoperative multimodal pain management: a narrative review of current practices, clinical and educational gaps, and future directions. *Frontiers in Anesthesiology*. 2025;4:1709252. <https://doi.org/10.3389/fanes.2025.1709252>
24. Dieter AA, Conklin JL, Willis-Gray MG, Desai S, Grant M, Bradley MS. A systematic review of randomized trials investigating methods of postoperative void trials following benign gynecologic and urogynecologic surgeries. *Journal of minimally invasive gynecology*. 2021;28(6):1160-70. e2. <https://doi.org/10.1016/j.jmig.2021.01.016>
25. Dong X, Huang W, Niu J, Lei T, Tan X, Guo T. Methods of postoperative void trial management after urogynecologic surgery: a systematic review and meta-analysis. *Systematic Reviews*. 2023;12(1):115. <https://doi.org/10.1186/s13643-023-02233-1>
26. Castellani D, Rubilotta E, Fabiani A, Maggi M, Wroclawski ML, Teoh JY-C, et al. Correlation between transurethral interventions and their influence on type and duration of postoperative urinary incontinence: results from a systematic review and meta-analysis of comparative studies. *Journal of Endourology*. 2022;36(10):1331-47. <https://doi.org/10.1089/end.2022.0222>
27. Yang J, Song H, Zhan H, Ding M, Luan T, Chen J, et al. The influence of preoperative urodynamic parameters on clinical results in patients with benign prostatic hyperplasia after transurethral resection of the prostate. *World Journal of Urology*. 2023;41(12):3679-85. <https://doi.org/10.1007/s00345-023-04656-w>
28. Bolton WS. Improving surgical outcomes in low and middle-income countries through surgical technology innovation: University of Leeds; 2022. <https://etheses.whiterose.ac.uk/id/eprint/31967/>