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Original Research Article

Robotic assisted hysterectomy in a teaching hospital over ten years: trends, outcomes and service evolution

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ABSTRACT

Background: Robotic hysterectomy is increasingly utilised in gynaecology, particularly for patients with obesity, significant comorbidities, or oncological indications. Castle Hill Hospital established a robotic hysterectomy service in 2016. This study evaluates perioperative outcomes and trends in operative efficiency over a ten-year period in a high-risk, complex cohort.
Methods: Authors conducted a retrospective review of 374 patients who underwent robotic hysterectomy between 2016 and 2025. Collected data included patient age, BMI, comorbidities, prior abdominal surgery, surgical indication, intra- and postoperative complications, conversion to laparotomy, hospital stay and mean operating times.
Results: Patient ages ranged from 29 to 87 years. Obesity was common, with 81% having a BMI ≥30, and 71% had multiple comorbidities, most frequently cardiovascular or metabolic. One-quarter had a history of open abdominal surgery. Endometrial cancer was the primary indication in 65%, mostly early-stage. Additional procedures included pelvic lymph node sampling (84 cases), adhesiolysis, omental biopsy, omentectomy, and appendectomy. Forty-one women (10.96%) had intraoperative complications, out of which 23 (6.15%) had conversion to laparotomy, mostly due to surgical difficulty, bleeding, adhesion or for specimen retrieval. Postoperative complications were seen in 10.4%, with two returns to theatre. Length of stay was brief, with 76% discharged within 48 hours. Mean operating time improved from 193–195 minutes in 2016–2017 to 140 minutes (2025).
Conclusion: Robotic hysterectomy is safe and effective in complex, high-risk patients. Low complication and conversion rates, short hospital stays, and improved operative efficiency reflect increasing service maturity, reduced resource use, and potential cost-effectiveness.

Keywords: Robotic hysterectomy, Complications, Trend, Outcomes, Endometrial cancer

INTRODUCTION

Hysterectomy remains one of the most frequently performed major gynaecological procedures worldwide and is indicated for a broad range of benign and malignant conditions, including abnormal uterine bleeding, fibroids, endometriosis, pelvic organ prolapse, and gynaecological malignancies. Over the last two decades, there has been a substantial shift towards minimally invasive surgical approaches due to their proven advantages over open abdominal surgery, including reduced perioperative morbidity, shorter hospital stays, decreased postoperative pain, lower wound complication rates, and faster postoperative recovery.[1] Increasing prevalence of obesity, multiple medical comorbidities, and previous abdominal surgery has added considerable operative complexity to

modern gynaecological practice. These factors are associated with technical challenges including reduced surgical access, limited instrument mobility, increased adhesiolysis, and prolonged operating times.[2] Consequently, robotic-assisted surgery has emerged as an important adjunct within minimally invasive gynaecological surgery, particularly for patients with high body mass index (BMI), extensive pelvic pathology, or oncological disease requiring complex dissection and staging procedures.[3] Robotic-assisted hysterectomy was introduced into gynaecological practice in the early 2000s following the development of computer-enhanced surgical platforms, with increasing adoption across the United Kingdom during the last decade, particularly in tertiary oncology centres. Internationally, robotic surgery now represents an increasingly substantial proportion of minimally invasive hysterectomies, particularly in high-income healthcare systems. The robotic platform offers several technical advantages over conventional laparoscopy, including three-dimensional high-definition visualisation, articulated instruments with enhanced dexterity, tremor filtration, and improved surgeon ergonomics, which may facilitate minimally invasive surgery in technically demanding cases while maintaining favourable perioperative outcomes.[4-5]

Despite increasing uptake, there remains limited long-term real-world data describing the evolution of robotic hysterectomy services within NHS practice, particularly regarding changing case complexity, operative performance, and perioperative outcomes over extended periods. This study presents a retrospective longitudinal service evaluation audit of robotic hysterectomies performed over 10 years (2016–2025) at Castle Hill Hospital, a tertiary NHS centre.

METHODS

This retrospective observational study was conducted within the robotic gynaecological surgical unit of a tertiary teaching hospital. The aim was to evaluate the trend over years, patient profile, and clinical & perioperative outcomes of robotic hysterectomy performed at a teaching hospital over a 10-year period.

All patients who underwent robotic-assisted hysterectomy between September 2016 and December 2025 were included in the analysis. Data were retrospectively obtained from multiple institutional sources, including theatre logbooks, electronic patient records, operative notes, and discharge summaries, to ensure comprehensive case identification and outcome assessment. Collected variables included patient demographics (age, body mass index, comorbidities, and indication for surgery), perioperative parameters (operative duration, estimated blood loss, conversion to open surgery, and intraoperative complications), and postoperative outcomes (length of hospital stay, postoperative complications, and 30-day readmission rates). Data were collected using a proforma, entered in MS Excel sheet and analysed using descriptive statistical methods.

RESULTS

Three hundred and seventy-four robotic hysterectomies were performed in Castle Hill Hospital in between 2016 and 2025 excluding cases where the robot was not docked after initial laparoscopic assessment, as deemed unsuitable for robotic approach. Out of 374, year wise distribution (Figure 1) showed gradual increase in number of cases over the years. Authors also analysed the year-wise distribution of mean operative time. The mean operative time decreased substantially from approximately 193–195 minutes in 2016–2017 to 118 minutes in 2024, indicating a marked improvement over time (Figure 2). Age group wise, the age range was 29 to 87 years, with the most common age group being 60-69 years (35.29%) followed by the age group of 50-59 years and 70-79 years, both of which accounted for 22% of cases each. Overall, more than three fourth of the women were of the age group 50-79 years. Although the most common BMI group was 30-39.9 (36.63%), overall, almost 45% of our women had morbid obesity (BMI of 40 or above) (Table 1).

There were no associated medical comorbidities in 87 of women, whereas 287 women (76.74%) had one or more medical comorbidities. Among these, the majority (267 of 287; 93%) had multiple comorbid conditions. Given the large study population and the wide spectrum of comorbidities, often involving multiple organ systems, comorbid conditions were categorized into broad groups based on the system involved for the purpose of analysis. Evaluation of medical comorbidities showed that cardiovascular conditions (hypertension, ischemic heart disease, and heart failure) were the most common, accounting for 33.49%, followed by metabolic disorders (diabetes mellitus, hypo/hyperthyroidism, and hypercholesterolemia), which constituted 26.88% (Table 2).

In this high-risk, complex population, many women had a history of prior surgical interventions, ranging from caesarean sections to laparoscopic and open abdominal procedures. For analytical purposes, previous surgeries were categorized into three groups: laparoscopy for upper abdominal pathology, laparoscopy for lower abdominal pathology, and laparotomy, including caesarean section. While a substantial proportion of women had no prior surgical history, others had undergone multiple surgical procedures (Table 3). Authors have analysed the indications of the hysterectomies among the study population (Table 4). Endometrial carcinoma was the most common indication, accounting for more than 60% of cases, followed by premalignant cervical lesions and endometrial hyperplasia with atypia. This table also represents the subgroup analysis of endometrial carcinoma cases, demonstrating that endometrioid carcinoma was the most common histological type in the population. Additionally, most of these cases were diagnosed at an

early stage, with stage IA disease representing the most frequently observed stage at presentation. Regarding perioperative findings, approximately two-thirds of cases (238 out of 374) had a normal-sized uterus, while approximately one in four had a bulky uterus (87 cases) and roughly one in ten had a multi-fibroid uterus (49 cases). In addition to robotic hysterectomy, several concomitant procedures were performed (Table 5). The most common additional procedure was bilateral pelvic lymph node sampling (84 cases), followed by adhesiolysis (67 cases). Other procedures included colposcopy (29 cases), omentectomy (22 cases), omental biopsy (11 cases), cystoscopy with insertion of ureteric stents (5 cases), and appendectomy (4 cases). Forty-one women (10.96%) had intraoperative complications, out of which 23 (6.15%) had conversion to laparotomy. Vaginal tears were the second most common intraoperative complication (9 cases) followed by bleeding requiring intraoperative drain placement or laparotomy, injury of bladder, bowel and surgical emphysema (Table 6). Most of the vaginal tears were managed conservatively with vaginal pack, except three cases which required additional haemostatic sutures. Out of all seven intraoperative haemorrhages, two required conversions to laparotomy and one required a blood transfusion. The conversion to laparotomy was required for 23 women for various reasons, the most common being intraoperative surgical difficulty. In 10 cases, conversion was required for challenges such as uncontrolled bleeding, dense adhesions, and distorted surgical anatomy. In 2 cases, laparotomy was performed to manage iatrogenic bladder and gastric injuries (Table 6). Regarding post operative outcome, most common complication we encountered was secondary vaginal bleeding due to vault infection requiring oral antibiotics in eleven women (2.94%). 11 women needed ICU admission, out of which 7 was planned admission for monitoring due to medical comorbidities, the remaining 4 were unplanned admissions to ICU due to various post-op complications including atrial fibrillation, dyselectrolytemia and ketoacidosis. Prolonged hospital stay was needed for 9 women requiring antibiotic treatment for infection (wound, urinary or chest). (Table 7). Pelvic collection occured in 2 women, and 2 required urinary catheterisation for urinary retention.

Table 1: Distribution of the population according to BMI.

BMI	Number of women	Percentage distribution
<30	70	18.72
30-39.9	137	36.63
40-49.9	108	28.88
≥50	59	15.77

Table 2: Medical comorbidities.

Category	Comorbidities	N	Percentage
Cardiovascular	HTN, AF, HF, Angina, IHD	147	33.49
Metabolic	DM, Hypo or hyperthyroid, Hypercholesterolemia	118	26.88
Musculoskeletal	Osteoarthritis, RA, Spondylosis, Fibromyalgia	58	13.21
Respiratory	COPD, Asthma, OSA, lung sarcoidosis	40	9.11
Gastrointestinal	Diverticular disease, UC, GERD, Coeliac disease	33	7.52
Chemoradiotherapy (CTRT) for other malignancy	Breast CA, Cervical CA	13	2.96
Neurological	TIA, Migraine, Parkinson, Stroke, MS, Meningioma, CVA	12	2.73
Hematological	Deep vein thrombosis (DVT), PE	10	2.28
Renal	CKD	6	1.37
Others	Behcet disease, Gorlin syndrome	2	0.45

Table 3: Previous abdominal surgeries.

Category	Surgical procedures	Number	Percentage
Previous laparoscopy for upper abdominal pathology	Cholecystectomy, laparoscopic gastric banding	42	26.42
Previous laparoscopy for lower abdominal/pelvic pathology	Sterilization, ovarian cystectomy, appendicectomy, diagnostic laparoscopy	29	18.24

Continued.

Category	Surgical procedures	Number	Percentage
Previous laparotomy including CS	Caesarean section, myomectomy, bowel resection for sigmoid tumor, open cholecystectomy, diverticular disease, hemicolectomy, splenectomy, colostomy	88	55.34

Table 4: Indications of robotic hysterectomies.

Indication of surgery			Number of cases	Percentage
Endometrial carcinoma			244	65.24
Subgroup analysis of endometrial cancer	Endometrioid	Endometrioid Stage 1A	133 (54.50%)	
		Endometrioid Stage 1B	82 (33.61%)	
		Endometrioid Stage 2 or above	7 (2.87%)	
	High grade serous		19 (7.79%)	
	Clear cell carcinoma		1 (0.41%)	
	Carcinosarcoma		1 (0.41%)	
	Endometroid stromal sarcoma		1 (0.41%)	
Cervical carcinoma			7	1.87
Premalignant lesion of cervix			53	14.17
Endometrial hyperplasia with atypia			39	10.42
Menorrhagia			8	2.14
Persistent post-menopausal bleeding (PMB)			7	1.87
Chronic Pelvic pain			4	1.07
Completion surgery (BOT/fallopian tube cancer)			8	2.14
Persistent vaginal discharge post CRT for CA cervix			1	0.27
PCB after LLETZ			1	0.27
Lynch syndrome with increased risk of ovarian and endometrial cancer			1	0.27
Psammoma bodies of uncertain significance			1	0.27
Total			374	100

Table 5: Additional procedures performed alongside robotic hysterectomy.

Name of additional procedure	Number of cases
Bilateral pelvic lymph node sampling	84
Adhesiolysis	67
Colposcopy	29
Omentectomy	22
Omental biopsy	11
Cystoscopy with insertion of ureteric stents	5
Appendectomy	4

Table 6: Intraoperative complications.

Intraoperative complications		Number of cases
Conversion to laparotomy (Total:23)	Surgical difficulty (dense adhesion)	8
	Surgical difficulty (bleeding)	2
	To retrieve specimen	6
	Surgical complication (Bladder injury, gastric injury)	2
	Equipment failure	2
	Retrieve missing swab	1
	Anesthetic reason (hypercapnia)	2
Vaginal tears		9
Intraoperative bleeding (managed laparoscopically)		5
Small Bowel injury		1
Surgical emphysema		2
Unexplained hematuria		1

Table 7: Post operative complications.

Post operative complications	Number of women	Percentage
Secondary vaginal bleeding due to vault infection	11	2.94
Planned ICU admission	7	1.87
Unplanned ICU admission	4	1.06
Post operative infection requiring prolonged antibiotic treatment	9	2.42
Return to theatre	2	0.53
Urinary retention	2	0.53
Pelvic collection	2	0.53
Post operative ileus	1	0.27
Left common peroneal nerve palsy	1	0.27
Total	39	10.42

Return to theatre was required for 2 women; 1 underwent a haemostatic suture for a vaginal tear immediately after her primary surgery while the other patient was readmitted 10 days post-surgery with complete vaginal vault dehiscence necessitating re-suturing of the vaginal vault. This patient had a total blood loss of 2 Litres requiring a blood transfusion. Regarding length of hospital stay, nearly half of the women were discharged within 24 hours, and more than three-quarters were discharged within 48 hours postoperatively (Figure 3).

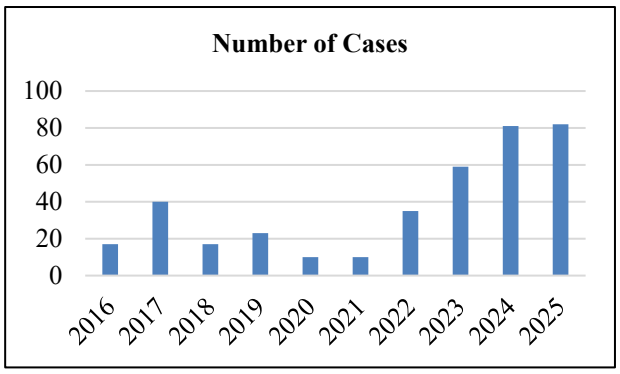

Figure 1: Distribution of cases over the years.

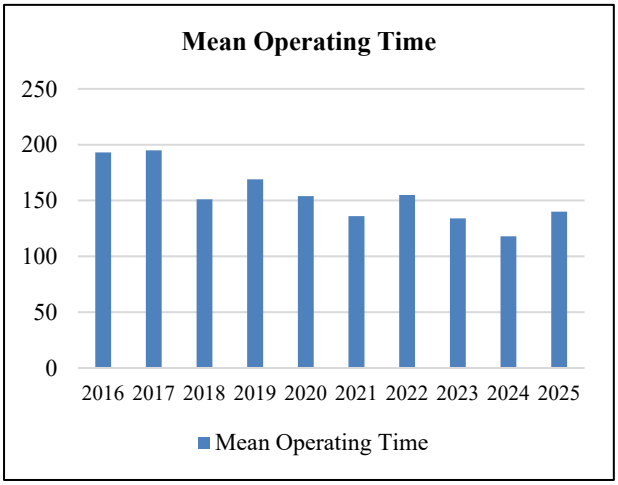

Figure 2: Year wise mean operating time.

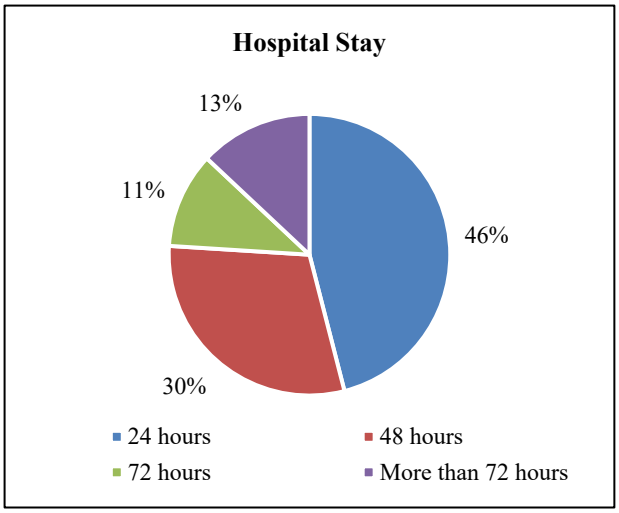

Figure 3: Length of hospital stay.

DISCUSSION

Within the United Kingdom, national healthcare policy has increasingly supported the structured expansion of robotic-assisted surgery services. Recent guidance from the National institute for health and care excellence (NICE) has supported the use of robotic-assisted surgery systems for soft tissue procedures within specialist centres, acknowledging potential benefits in surgical precision, recovery, and perioperative outcomes.[6] In parallel, the getting it right first time (GIRFT) programme and NHS England have advocated the expansion of robotic-assisted surgery through structured governance, dedicated training pathways, outcome monitoring, and equitable patient access to minimally invasive surgery, particularly for complex and high-risk procedures.[7] These national recommendations align with broader NHS objectives aimed at reducing hospital stay, increasing minimally invasive surgery rates, and improving perioperative recovery. This study demonstrates a substantial and sustained increase in the utilisation of robotic hysterectomy over a 10-year period. Annual case volume rose overall from 17 procedures in 2016 to 82 in 2025, despite a transient decline during 2020–2021, likely reflecting disruption to elective services during the

COVID-19 pandemic. This pattern mirrors wider international trends, where adoption of robotic surgery accelerates following an initial implementation phase as institutional experience and infrastructure develop.[8] The marked increase from 2022 onwards in this cohort likely reflects both service recovery and increasing surgeon confidence in robotic systems.

The demographic profile of patients- aged 29–87 years, with a predominance in the 60–69-year group and a high proportion with BMI 30–39.9- reflects a typical tertiary referral population. The predominance of endometrial cancer (65.2%) as the primary indication further highlights the central role of robotic surgery in gynaecological oncology. These findings are consistent with existing evidence showing that robotic hysterectomy is frequently utilised in complex and high-risk populations, particularly in obese patients where minimally invasive surgery is technically challenging.[8,9] Prior studies have demonstrated that robotic platforms maintain performance even in more complex pathology and higher uterine weights, supporting their use in such cohorts.[10] Though studies have not proven to show superiority of robotic platform over laparoscopic surgery for benign indications, in complex cases including obesity and large uteri, robotic surgery have shown a benefit.[11-13]

Operative efficiency improved over time, with mean operative duration decreasing from 193–195 minutes in the early years to 118 minutes in 2024, reflecting the well-established learning curve associated with robotic surgery. However, there was a slight increase of operative time to 140 minutes in 2025, which was possibly due to increased complexity of the cases selected owing to increased surgical confidence and refinement of robotic techniques over the study period. Evidence suggests that proficiency in robotic hysterectomy may be achieved after approximately 19–20 cases, with progressive reductions in operative time thereafter.[10,14] Importantly, robotic surgery has been shown to have a relatively short and manageable learning curve compared with other minimally invasive techniques, facilitating wider adoption among surgeons.[15] The slight increase in operative time in the final year may reflect expansion into more complex surgical cases, a phenomenon also observed in high-volume centres.

The safety profile observed in this study is consistent with published data. Conversion to laparotomy occurred for multiple reasons, most commonly adhesions and specimen retrieval difficulties, reflecting the complexity of cases undertaken. Previous studies similarly report that robotic hysterectomy is often performed in patients with larger uteri or more complex pathology, which may inherently increase the likelihood of intraoperative challenges.[8] Despite this, overall complication rates remained low. Minor complications such as vaginal tears and manageable intraoperative bleeding were more common, while major complications, including bowel injury, were rare. These findings align with comparative studies demonstrating that robotic and laparoscopic hysterectomy have similar complication rates and perioperative outcomes.[8] Postoperative recovery was favourable, with 76% of patients discharged within 48 hours. This is consistent with existing literature, indicating that minimally invasive hysterectomy-whether robotic or laparoscopic-is associated with shorter hospital stay, reduced blood loss, and faster recovery compared with open surgery.[8] Furthermore, evidence suggests that robotic hysterectomy may offer additional benefits in complex cases, including reduced blood loss and a shorter hospital stay, in patients with larger uteri or higher surgical complexity.[10] In the context of the National Health Service, these factors are particularly relevant, as shorter hospital stays may contribute to improved bed utilisation and healthcare efficiency.

Taken together, these findings support the evolving role of robotic hysterectomy within tertiary gynaecological practice. While outcomes are broadly comparable to laparoscopic surgery in standard cases, robotic platforms appear to extend the feasibility of minimally invasive approaches to more complex patients, particularly those with obesity or malignancy. This reinforces the concept that robotic surgery serves as an enabling technology rather than a universally superior alternative.

However, several limitations must be acknowledged. The retrospective design introduces the potential for selection bias, particularly as robotic surgery was preferentially utilised in more complex cases. The absence of a direct comparator group limits the ability to draw definitive conclusions regarding superiority over laparoscopic or open approaches. Additionally, this is a single-centre study, which may limit generalisability across the NHS, particularly in centres without established robotic programmes. Ensuring equitable access to robotic surgery remains a key challenge as this technology becomes increasingly embedded in clinical practice.

CONCLUSION

Despite the limitations, this study provides valuable real-world insight into the adoption and impact of robotic hysterectomy within a UK tertiary centre. The findings support continued expansion of robotic services, alongside the need for prospective multicentre studies, long-term outcome data, and robust cost-effectiveness analyses.

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