

Robotic-Assisted Cholecystectomy: Experience from Pakistan

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ABSTRACT

Objective: To determine the console time and safety of robotic-assisted cholecystectomy using the Versius system.

Study Design: An observational study.

Place and Duration of the Study: Department of Surgery, National Hospital and Medical Centre, Lahore, Pakistan, from May 2022 to March 2024.

Methodology: Cases of robotic-assisted cholecystectomy were reviewed. Prospective data was collected. Informed consent regarding surgery and the use of clinical data was obtained. Confidentiality of patient information was maintained. Perioperative variables and postoperative follow-up were recorded, and 90-day morbidity, readmission, and mortality were noted.

Results: A total of 156 cases of robotic-assisted cholecystectomy were performed. Most of the patients were female (n = 115, 73.71%). The overall mean console time was 63.04 ± 33.14 minutes. There were no readmissions, mortality, or 90-day morbidity. Only one patient (0.61%) had a bleeding complication, requiring laparoscopic exploration.

Conclusion: In appropriately selected cases, robotic-assisted cholecystectomy surgery is safe, and its short-term outcomes are comparable to laparoscopic surgery. Console time is influenced by patient gender and gallbladder characteristics.

Key Words: Robotic-assisted, Cholecystectomy, Pakistan, Initial experience, Versius system.

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INTRODUCTION

Technology has made remarkable progress in recent decades. The 1980s saw the evolution of laparoscopic cholecystectomy. In 2000, the first robotic surgery system, *da Vinci* (Intuitive Surgical, California, USA) received approval from the United States Food and Drug Administration (FDA). Although robotic surgery seems to be a natural evolution from laparoscopy, its use has been limited, mostly due to high cost and a steep learning curve.¹

The first robotic cholecystectomy was reported in 1997 by Belgian Jacques Himpens.² Pakistan acquired the first robotic surgical system *da Vinci*, in 2011. Despite running into problems, progress has been made in the past few years with a number of different systems being acquired in the cities of Lahore and Karachi.^{3,4}

In this study, the authors present their initial experience with robotic-assisted cholecystectomy using the Versius system. To date, only a few centres in Pakistan have performed robotic surgery. The authors' centre acquired the Versius system in 2022.⁵ Being scarce, the safety and advantages of the system have not been studied in the local population. This study aimed to determine the console time and assess the safety of robotic-assisted cholecystectomy at a tertiary care centre.

METHODOLOGY

The data were collected prospectively. It was a single-centre study, where a total of 156 cases of robotic-assisted cholecystectomy were performed, between 29th May 2022 and 31st March 2024. Ethical approval from the Hospital Ethical Committee was obtained. Informed consent was obtained from all patients included in this study. Sample size was based on existing literature showing initial experience with the Versius system.^{6,7}

All patients who presented with symptomatic gallstone disease at the hospital were educated regarding laparoscopic and robotic surgery. The differences between the two surgical methods, including cost, were explained to the patients. Those who opted for robotic surgery underwent further workup as per routine, which included routine blood tests and a preoperative ultrasound with particular attention to signs of acute or chronic cholecystitis. Such patients were advised to undergo the laparoscopic approach initially, as there was a greater chance of

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conversion to a hybrid or conventional laparoscopic procedure. Furthermore, patients were also excluded if they had any clinically significant unstable medical disorder or a previous history of open abdominal surgery. All procedures were performed by a team of robotically trained general surgeons at the institute.

All operations were performed under general anaesthesia. Cases scheduled as robotic surgery that had to be converted to another method (laparoscopic or open) were included in the study and classified as hybrid procedures. Prospective data were collected from the hospital information system and the Versius database. These data were subsequently reviewed and analysed. The only cases excluded were those initially planned for robotic surgery but withdrawn before the induction of anaesthesia.

The setup used by the authors for robotic-assisted cholecystectomy consisted of a surgeon console, two instrument bedside units, and one visualisation bedside unit. The port position is shown in Figure 1. After the induction of anaesthesia, pneumoperitoneum was created using the open method. Patients were then placed in a 30-degree reverse Trendelenburg position with a 15-degree left lateral tilt. The first 10-mm umbilical port was inserted at the infra-umbilical position. Two 5-mm mid-clavicular ports were inserted midway between the umbilicus and the epigastrium on either side. An assistant 10-mm port was inserted in the epigastrium to provide additional retraction for the application of clips.



Figure 1: Robotic arm setup and port placement.

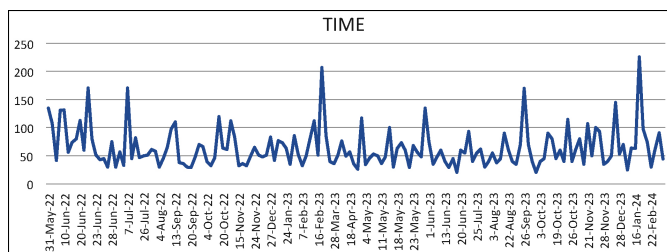


Figure 2: Console time in minutes over the duration of the study.

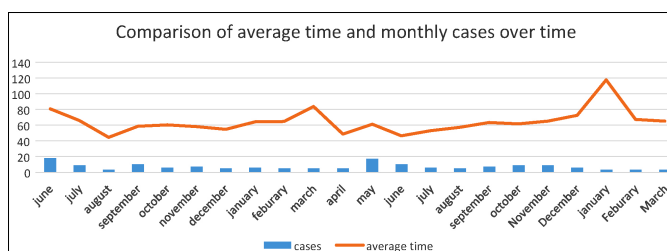


Figure 3: Variation in average console time in minutes with the number of cases.

The critical view of safety was achieved using a fenestrated grasper on the left side and a monopolar hook on the right. The procedure was started by the assistant applying traction *via* the 10-mm epigastric port to elevate the liver and visualise the gallbladder, followed by lateral traction on the gallbladder neck *via* the robotic grasper on the left. Anterior and posterior dissection were then performed using the monopolar hook controlled from the console. Clips were applied through the 10-mm epigastric port by the bedside assistant, while the 5-mm robotic arms provided traction and elevation of the liver. Structures were then cut with laparoscopic scissors *via* the epigastric port. Following completion of the dissection, the gallbladder was then removed *via* the umbilical port. A subhepatic drain was routinely placed in all cases. A similar approach has been described by other authors using the same system.^{6,7}

Excel Software (2013, Microsoft, USA) was used to analyse the data. Variables noted were the age of the patient in years, gender of patients, console time of surgery in minutes, and postoperative complications, morbidity, and mortality, within 90 days. The mean age of the patients was calculated in years. Gender distribution was calculated in terms of frequency and percentage. Frequency of 90-day postoperative complications, morbidity and mortality were calculated. The mean operative time of the first 30 cases was calculated and compared with the mean operative time of the next cases in the study. The mean operative time of cases was compared across genders and over successive months, and variations were noted. The postoperative course of all patients was recorded through outpatient department (OPD) visits and follow-up telephone calls.

RESULTS

A total of 156 cases of robotic-assisted cholecystectomy were performed between 29th May 2022 and 31st March 2024. Of which, 129 (82.69%) were in ASA Class 1 and 27 (17.31%) were in Class II. The mean age of patients in the study was 45.23 ± 14.35 years; 41 (26.28%) were male, and 115 (73.71%) were female. There were three conversions to laparoscopic surgery due to dense adhesions and oedematous gallbladder. The mean console time for the first 30 cases was 73.86 minutes; however, it decreased to 64.22 minutes for the next cases. The overall mean console time was 63.04 ± 33.14 minutes, with time ranging from 20 minutes to 226 minutes in the longest case. This variation after the initial cases seemed to be attributable to the patient's gender and gallbladder characteristics, especially the presence of cholecystitis, rather than the skill or learning curve of the patient. However, a variation among genders appeared; the mean operative time was shorter in females (61.00 minutes) as compared to men (73.43 minutes). Console time over the study period is given in Figure 2.

Only 1 patient had postoperative bleeding due to clip slippage (Table I). However, the case was managed successfully through a laparoscopic approach. The patient was discharged within 48 hours and had an uneventful course after that. The time variations with gender are shown in Table II.

Table I: Postoperative complications.

| Complications | Cases |
|-------------------|-----------|
| Bleeding | 1 (0.64%) |
| Blood transfusion | 1 (0.64%) |
| Bowel injury | 0 |
| Bile duct injury | 0 |
| Bile leak | 0 |
| Wound infection | 0 |
| Chest infection | 0 |

Table II: Variation in operating time in minutes across genders.

| Gender | Number of cases | Operating time (in minutes) Mean \pm SD |
|--------|-----------------|--|
| Male | 41 (26.28%) | 73.43 \pm 41.55 |
| Female | 115 (73.72%) | 61.00 \pm 31.75 |

DISCUSSION

Over the past 25 years, robotic surgery has made great progress and is now increasingly used in complex pelvic surgery. However, its use in general surgery has remained limited, mainly due to high cost and lack of interest. The introduction of newer robotic systems has led to a renewed interest. With the increasing availability of systems, decreased costs, and a growing number of trained surgeons, its use in general surgery is expected to become more widespread in the near future.^{8,9}

The study centre is the first in Pakistan to establish the Versius robotic system by CMR. Since its introduction, more than 300 cases across different specialties have been performed, the majority of which were done by the Department of General Surgery. This paper presents the experience of the initial 156 cases of robotic-assisted cholecystectomy performed at the institute.

The patients were mostly females. As it was an initial experience, case selection included simple and straightforward cases. A similar policy has also been adopted by other surgeons in their practice.¹⁰ The authors evaluated the experience with this new surgical robot and examined the learning curve and postoperative outcomes, considering the first 30 cases as the learning curve.¹¹ Operative time improved as the number of cases increased. However, a few difficult cases required longer durations, especially when an acutely inflamed gallbladder was encountered (Figure 3). The mean postoperative hospital stay was 1.03 \pm 0.27 days, while 90-day morbidity, readmissions and mortality was 0. Similar findings had been reported previously on the *da Vinci* robotic system.¹² Kelkar *et al.* performed a total of 143 cholecystectomies on the same system and reported a successful robotic-assisted completion rate of 93.7% (134/143), while, in this study, the authors were able to complete 153/156 (98.07%) cases.¹³

A number of difficulties were faced, which required modification of routine laparoscopic techniques. The accessory epigastrium port was used to provide retraction to lift up the liver and visualise the gallbladder and Calot's triangle. The left-handed grasper provided adequate retraction to simple gallbladder;

however, considerable difficulty was encountered in an acute oedematous gallbladder. At present, the system lacks a monopolar curved Maryland dissector, a limitation which was overcome by using a right-sided L-hook. Such difficulties have also been reported by other users of the same system.^{6,7}

With increasing improvement and decreasing costs in the robotic systems, it is likely that there will be greater acceptance for common general surgical procedures. Especially, modular cart-based systems with less financial cost are more likely to be accepted and applied.¹⁴

Additional advantages such as ease of use, increased comfort, better ergonomics, 3-D magnified vision, and integrated AI are likely to benefit both surgeons and patients. However, proper training of surgeons and staff is necessary, requiring time and cost. Although the financial aspect was not evaluated in this study, it is clear that the initial setup cost of robotic surgery is higher than that of laparoscopic surgery. However, with time, the cost is expected to decrease.¹⁵

The main strength of the study is that it represents the first and largest cohort of robotic-assisted cholecystectomies performed on the Versius platform in Pakistan. However, the study had certain limitations. It was an observational study, and due to cost considerations, most patients belonged to a younger, educated, and financially stable class. Furthermore, as this was the initial experience with this new robotic system, patient selection was highly selective. Detailed follow-up will be needed to determine the long-term outcomes in these patients.

CONCLUSION

In appropriately selected cases, robotic-assisted cholecystectomy surgery is feasible and has short-term outcomes comparable to laparoscopic surgery.

ETHICAL APPROVAL:

This study was approved by the Ethical Committee of the National Hospital and Medical Centre, Lahore, Pakistan (Ref No. NHMC/1035; Dated: 30-7-2023).

PATIENTS' CONSENT:

Informed consent was taken from the patients to publish the data of this study.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

UIB, MA, MWF, MU: Conception of the study, acquisition and analysis of data, and drafting of the manuscript. All authors approved the final version of the manuscript to be published.

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