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A COMPARATIVE STUDY OF COST AND CLINICAL OUTCOME OF ROBOTIC-ASSISTED VERSUS CONVENTIONAL SURGERIES IN A TERTIARY CARE HOSPITAL OF NORTH INDIA

Management

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ABSTRACT

Background and Objectives: Open and Laparoscopic urological surgeries, with and without robotic assistance, are performed to treat both benign and malignant disease. This study compared clinical and economic outcomes for conventional surgeries and surgeries with robotic assistance.

Methods: Patients aged above 18 years having need for primary inpatient urological procedures identified by ICD (International Classification of Diseases,) Ninth Edition procedure codes were studied. Patients were matched to a control cohort using propensity scores for disease, co morbidities, and hospital characteristics. The outcomes of interest were hospital cost of laparoscopic robotic-assisted surgery compared with traditional mode of surgeries, surgery time, adverse events, and length of stay.

Results: Of 1000 laparoscopic surgeries identified, 95% were performed without robotic assistance and 4% were performed with robotic assistance. After matching, 120 patients remained, 60 in each group. Lengths of stay were significantly different between the matched cohorts, but there was no significant difference in rates of major, minor, and/or surgical complications.

Inpatient procedures with robotic assistance were significantly more costly than those without robotic assistance Operative times were significantly longer for robotic-assisted procedures.

Conclusion The robotic procedures may have prolonged operative times and substantial cost burden, but the significantly reduced average length of stay gives it a winning edge over conventional surgeries. Though these studies are still in preliminary stages , hence further investigation is warranted when considering robotic technology for routine laparoscopic surgeries.

KEYWORDS:

Robotic assisted, Robotic Surgery, Laparoscopic, Outcomes.

INTRODUCTION

It is suggested that approximately that more than 111000 men and women have urological complains and more than 50 percent of these undergo a surgical intervention / procedure for the correction. An open approach was the most frequently used technique till last decade , but laparoscopic techniques are being used now and have been well accepted.1– 3 The number of laparoscopic surgeries are increasing particularly in urban centers, where laparoscopic procedures are being performed on a higher rate than in other settings.2,3,5,6 Within a large Premier Hospital Database, approximately one-half of surgical procedures in department of urology (pyeloplasty , nephrectomy (partial / complete / radical) , Nephrostomy , ureterostomy , uretric reimplantation , VVF repair , radical prostectomy and adrenalectomy were identified as having Robotic / laparoscopic procedural code).

Laparoscopic techniques have minimized the peri operative morbidity associated with many types of surgery, 1 Several prospective randomized trials have shown that laparoscopic surgeries have equivalent outcomes to the traditional open surgical approach. Additional advantages with regard to pain, blood loss, return of bowel function, length of hospitalization, and overall recovery time have been shown.2. Fewer postoperative complications have also been noted.3 In addition, resource use is lower for laparoscopic surgeries, including reduced length of stay, fewer readmissions, and less use of skilled nursing facilities.3 Robotic-assisted surgery is an emerging approach in the field of laparoscopic surgeries. Although no specific large randomized controlled trials have evaluated robotic assisted versus traditional laparoscopic surgeries, clinical outcomes suggest that robotic-assisted laparoscopic surgery is equivalent to conventional laparoscopy when considering important endpoints such as conversion to open surgery, hospital stay, and recovery time.1.2. In this era of comparative effectiveness and health care reform, and with concerns about optimal resource utilization at the forefront, the use of robotic-assisted laparoscopic surgery deserves further evaluation. Given this background, this study examined clinical and economic outcomes (cost and utilization) in patients undergoing laparoscopic surgeries performed with and without robotic assistance.

MATERIALS AND METHODS

Data Source - Postgraduate Institute Of Medical Education And Research , Chandigarh (A 2000 bedded institute of national importance) database was used as the data source for this study. Data was collected from a predesigned and tested validated questionnaire from the patients attending Advanced urology centre`s services located in Nehru Hospital, PGIMER, Chandigarh. It consisted of complete patient billing, hospital cost, and histories from more than 3000 patients admitted for procedures in AUC. A protocol describing the analysis objectives, criteria for patient selection, data elements of interest, and statistical methods was submitted to the institute ethical committee and permission was obtained before the start of study . Eligible patients were aged above 18 years. Consent was taken from relatives and patients. Patients were also categorized according to the types of surgeries

For all eligible patients, elements describing hospital cost, surgery time, and length of stay, use of the robot, disease type, and indication for surgery were obtained from the data. Cost analysis (calculation) reflected the cost to the hospital for the procedures but did not include capital costs. This analysis was limited to the total cost per patient episode and did not break out costs at the level of disposables, operating room time, or other patient care costs. The specific cause of total cost differences was not formally evaluated. The preoperative All Patient Refined Diagnosis Related Groups severity level was used as an index of co morbidity. It is used to account for differences related to an individual's severity of illness or risk of death in large datasets. Co morbid conditions that might influence procedure selection or outcomes of interest, such as the presence of cardiovascular or pulmonary disease, cancer, or diabetes mellitus, were obtained by use of ICD-9 diagnosis codes and were excluded from the study samples . Information health insurance status was also included.

Table 1. Attrition Process Description
Table 2.
Table 3. Hospital Costs, Surgery Time, and Length of Stay After Matching
Table 4 . Complications
Table 5. Comparison of laparoscopic and Robotic Surgeries

RESULTS

A total of **3010** patient visiting AUC were used for the study , **200** patients were excluded from the studying owing to presence of co-morbidities , hence the corrected sample size was recorded as **2800** , further the group were subdivided into Robotic and Non Robotic surgical intervention. **2690** and **120** patients were found fit for each group respectively (Non Robotic group 1 , and Robotic (group 2) . The patient attrition process is shown in Table 1. Ninety-six (**96%**) percent of all surgeries included in this analysis were performed without the use of robotic assistance. Robotic assistance was used in 120 procedures, or approximately 4% of the total surgical procedures. The procedural breakdown was as follows: (nephron sparing surgery or partial nephrectomy, pyeloplasty, radical prostectomy, radical cystectomy, reimplantation surgery). Before matching, distributions were similar for age, gender, insurance, for patients in both groups (Table 2). On further evaluation it was found maximum influx of patients were from age group 51 years to 70 years (approx 50 percent). Further approximately 50 percent of patients were present or ex-government employees or their dependents.

After matching, 60 patients were taken as for comparison in both groups, (Table 3) .After matching, clinical endpoints and adverse events occurring in the hospital stay and postoperative period and within 30 days after discharge were tabulated and grouped into 4 categories: major, minor, surgical, and misc. Complications (major, minor, and surgical) and misc were not significantly different between the robotic and non robotic surgery cohorts, regardless of whether they were examined within a peri operative 30-day period or only within the original peri-operative hospital stay (Table 4)

Cohorts were also tested for differences in average hospital costs, surgery time, and length of stay (Table5). The average length of stay of the two cohorts was statistically different (5.2 days for robotic vs. 15.5 days for non robotic, P .001). The inpatient surgery time was significantly longer for robotic-assisted procedures (4.37 hours; 95% confidence interval [CI], 4.24–4.51 hours) than for non robotic procedures (3.34 hours; 95% CI, 3.23–3.46 hours) (P= .001). But this difference of operative times had decreased by approximately 10 % from the operative times achieved previously when the robotic surgery lab was commissioned in Nov 2014 , the reason for this substantial decrement being better learning curve for surgeons. However the cost for procedure were substantially higher for robotic-assisted procedures than for procedures without robotic assistance (INR 58073 vs. INR 97255, P = .545).

DISCUSSION - This study showed that in a real-world setting, one-third of all urological surgeries are performed by a minimally invasive approach, the vast majority without robotic assistance (95%). When well-matched cohorts are compared, the results of laparoscopic surgeries with and without robotic assistance are similar with respect to clinical outcomes but vary greatly in length of stay and when considering preoperative complications. Robotic-assisted procedures were associated with higher hospital costs and a little longer surgery times, which however may decrease with increased competency of operating surgeons. Although not all of these cases examined specifically follow the trend but these results do provide directional understanding of cost comparisons for robotic-assisted minimally invasive procedures with other non robotic surgeries. This may also be an reflection due to differences in single site, surgeon and hospital learning curves, and heterogeneity in patient populations. This study also had some noteworthy limitations like exclusion of patients with co morbidity, learning graph of operating surgeons . Furthermore, data regarding the precision of robotic versus non robotic procedures, including surgical margins and adequacy of lymph node dissection, could not be evaluated. The analysis was limited to a 30-day peri-operative period, which limits analysis related to long term survival or potential long-term complications. Other limitations of this analysis include lack of comparison between rates of conversion to an open approach and differentiation between hand-assisted and total laparoscopic approaches. However, these limitations are inherent to the data source and could be rationalized to impact both cohorts similarly. As a result, the risk of bias in one cohort is lessened. Finally, surgeon and institutional learning curve relative to using robotic technology could not be evaluated.

CONCLUSION = This study represents the most up-to-date and expansive analysis of cost and effectiveness outcomes associated with robotic-assisted laparoscopic surgeries. These findings show few clinical differences in preoperative adverse events. Coupled with the increased per-case cost of the robot and increased operative times, the results suggest that further consideration is warranted before using this technology for surgeries when standard laparoscopic means yielding comparable results are available. Future studies evaluating cost relative to robotic-assisted case volume and prospective randomized controlled studies focusing on comparative effectiveness between traditional and robotic-assisted laparoscopic surgeries procedures are needed.

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