Original Research Paper

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ANAESTHESIA EXPERIENCE AND CHALLENGES IN 200 CASES OF ROBOTIC ASSISTED PROSTATE CANCER SURGERIES - A SINGLE CENTER RETROSPECTIVE CASE SERIES.

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ABSTRACT **Background -** Robotic technology have expanded the scope of laparoscopic prostate surgery. The requirements of prolonged pneumoperitoneum and steep Trendelenburg position, duration in elderly subset of patients has its complications. **Methods -** we Retrospectively reviewed 200 patients records who undergone Davinci Robotic prostate surgeries and their data has been collected. **Results-** ASA STATUS 2 in 76% of patients The Mean (standard deviation) age group were 66.85±6.9 years,MEAN(SD) BMI 25.06±5.4 kg/m²Anaesthesia time 235.45±42.5 min, Robo Dock time 186.78±41.9 mins , Blood loss 201.45±69.94 ,in ml of these patients smokers were around 33.5%,.Blood transfusions in 2% patients.Around 78% patients were ambulated in Day 1 and Total duration of hospital stay were 2 days in 61.5% of patients. Postop complications were Infection in 0.5% Lymphocele 0.5%,septic shock 0.5% urine leak 0.5%. **Conclusion-** Standard protocols and preoperative optimization,teamwork,and multidisciplinary input incorporating the most recent advances enabled us to perform complex robotic-assisted surgery on elderly patients with minimal complications.

KEYWORDS : Robotic prostate, Davinci surgery Anaesthesia, ERAS protocol

INTRODUCTION

Around 3000 cases of multiple specialisation, including uro onco surgeries, have been performed in Apollo hospitals chennai since the inception of Da Vinci robotic surgery in 2011.This case series from this single centre is a retrospective descriptive Anaesthesia experience and challenges of 200 uro oncologic Robotic assisted Prostate surgeries performed using the ERAS-Enhanced Recovery after surgery protocol.

Robot-assisted surgery allows for improved surgical exposure to pelvic organs and access, minimal blood loss, lower post-operative pain scores, earlier mobilisation, and faster discharge eligibility[1-2].

Radical prostatectomy is evidenced in randomized clinical trials to improve disease-specific survival and overall survival, Robotic uro oncosurgery has benefits of a shorter hospital stay and earlier discharge. Robots have been found to be able to circumvent some of the drawbacks of conventional laparoscopic surgery through provision of a three-dimensional perspective and wrist like movements one arm for endoscope in four arms with a surgeon console[1].

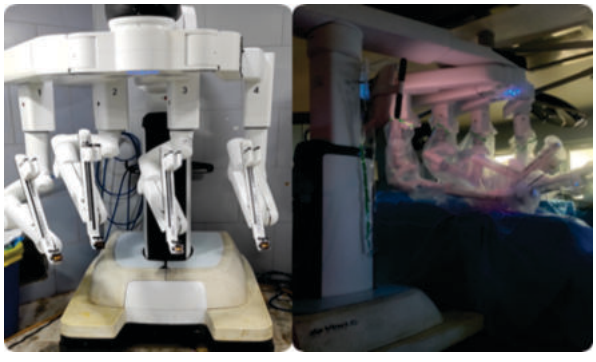


Figure 1- Davinci Xi Robot in idle and docked position.

Although it is said that robotic surgery has broadened the field of sophisticated laparoscopic surgery, anaesthesia for robotic surgery comes with its own set of difficulties. Pneumoperitoneum, the steep Trendelenburg position, learning curve,long duration and its accompanying issues including a cardiovascular system compromise , inadequate ventilation, elevated intraocular pressure as well as intracranial pressure[2]. positional harms, including, facial edoema, and peripheral nerve damage and delayed access to patient on emergency resuscitation[3]. All These issues may worsen in extremely obese people.As a result, anesthesiologists must be fully aware of, and capable of dealing with, the challenges posed by this technology, as well as any complications that may arise[6].

METHODS

This is a retrospective descriptive single centre case series of patients who underwent Robotic assisted Radical prostatectomy at Apollo Hospitals Chennai between 2013 and 2022, patients Statistics on age, demographics, BMI, ASA status, preoperative planning,

intraoperative challenges, blood loss and transfusions, postoperative recovery, ICU admissions, and total length of hospital stay have been collected with instituitonal approval and permission from the medical records and uro oncology records.

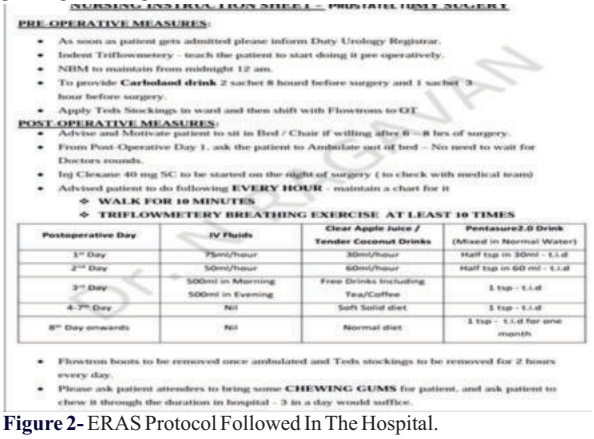
PREOPERATIVE SELECTION AND PREPARATION

Patients who were undergone Robotic prostate surgeries staged with Computed tomography,Magnetic resonance imaging to predict the pathologic stage of candidates, evaluated in anaesthesia assessment clinic and undergone routine investigations like complete blood count,renal function test,chest x ray,Electrocardiography,blood grouping to aid diagnosis of underlying systemic diseases.

Echocardiogram had been routinely done since patients are in elderly age group.pulmonary function tests,Arterial blood gas analysis are done based on patient Comorbidities and functional status and Patients are optimized as per their coexisting disease with physician association.

Preoperative Medication

Antiplatelet medications were stopped as per ASRA guidelines.After admission patients were reviewed and started with ERAS protocol involving initiation of Triflowmetry exercise,and TED Stockings for DVT Prophylaxis.Full Bowel preparation were avoided.clear fluids and carbload drink 8 hours before and 3 hours before surgery to avoid prolonged fasting.



NURSING INSTRUCTION SHEET – PROSTATE RADICAL SURGERY

PRE OPERATIVE MEASURES:

- As soon as patient gets admitted please inform Duty Urology Registrar.
- Indent Triflowmetery - teach the patient to start doing it pre operatively.
- NBM to maintain from midnight 12 am.
- To provide **Carbload drink** 2 sachet 8 hourd before surgery and 1 sachet 3 hour before surgery.
- Apply Teds Stockings in ward and then shift with Flowtrons to OT.

POST OPERATIVE MEASURES:

- Advise and Motivate patient to sit in Bed / Chair if willing after 6 – 8 hrs of surgery.
- From Post-Operative Day 1, ask the patient to Ambulate out of bed – No need to wait for Doctors rounds.
- Inj Clexane 40 mg SC to be started on the night of surgery (to check with medical team)
- Advised patient to do following **EVERY HOUR** - maintain a chart for it
  - ❖ **WALK FOR 10 MINUTES**
  - ❖ **TRIFLOWMETERY BREATHING EXERCISE AT LEAST 10 TIMES**

Postoperative Day	IV Fluids	Clear Apple Juice / Tender Coconut Drinks	Pentasure2.0 Drink (Mixed in Normal Water)
1st Day	75ml/hour	30ml/hour	Half tsp in 30ml - t.i.d
2nd Day	50ml/hour	60ml/hour	Half tsp in 60 ml - t.i.d
3rd Day	500ml in Morning 500ml in Evening	Free Drinks including Tea/Coffee	1 tsp - t.i.d
4- 7th Day	Nil	Soft Solid diet	1 tsp - t.i.d
8th Day onwards	Nil	Normal diet	1 tsp - t.i.d for one month

- Flowtron boots to be removed once ambulated and Teds stockings to be removed for 2 hours every day.
- Please ask patient attenders to bring some **CHEWING GUMS** for patient, and ask patient to chew it through the duration in hospital - 3 in a day would suffice.

Figure 2- ERAS Protocol Followed In The Hospital.

INTRAOPERATIVE CONSIDERATIONS

CONDUCT OF ANAESTHESIA

Patients were prewarmed once reaching waiting area with blankets and blow over warmers and patient identity confirmed.Theatre team communicated for resources as per patient pre operative assessment. one to two wide bore cannula were established as per requirement.

INDUCTION

Induction agents given were consistent with patient cardiovascular status and Comorbidities.Standard induction with Intravenous Fentanyl 1-2 mcg /kg ,Propofol 1-2 mg/kg ,Atracurium 0.5mg/kg bolus.Morphine 0.05-0.1 mg/kg or alpha 2 agonists.After preoxygenation and denitrogenation Endotrachel intubation with 8 ,8.5 and 9 mm endotracheal tubes were used in males and 7-8mm in females,usually largest possible size is preffered in view of trendlenberg and pneumoperitoneum.Regional neuraxial blocks and epidural anaesthesia were usually avoided as it is minimally invasive and impedes in early bowel function recovery and mobilization.

MAINTENANCE OF ANAESTHESIA

Maintenance with propofol infusion of 50-300 mcg/kg/min adjusted with Bispectral index Monitoring ,or sevoflurane with Air,Oxygen of Minimum Alveloar concentration of 0.9-1 are maintained under low flow anaesthesia.

Intraoperative challenges

1)Airway
2)Positioning
3)Access
4)pneumoperitoneum
5)Temperature
6)Blood loss.
7) Fluid Restriction
8) urine output monitoring
8)Hemodynamic challenges
9) Analgesia

Airway

Since most of the patients were in elderly age group edentulous,limited neck extension,chemotheraphy Radiotherapy induced airway changes were been presented as airway complications But no cases of failed intubation were occurred in this series.

Positioning

Steep Trendlenburg position upto 45° with modified lithotomy is employed for robotic assisted prostate surgery and locked until the end of surgery. Shoulder supports areemployed with strapping of patient.No table movements were allowed during surgery to until undocking the robot arms

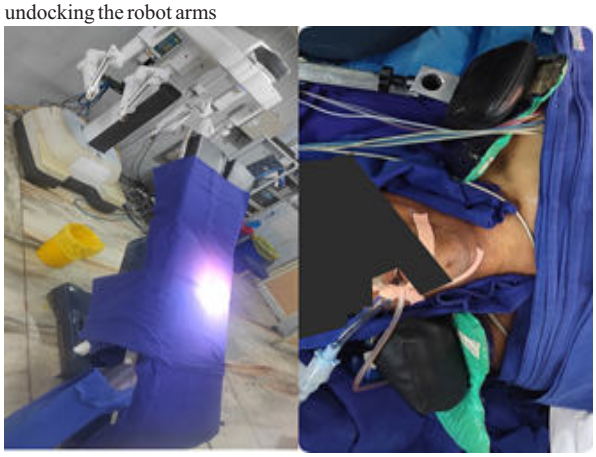


Figure 3- Remote Controlled OT Table In Steep Trendelenburg Employed In Prostate Surgery And Patient In Double Padded Shoulder Strap In That Position

ACCESS

Since surgery requires adduction of both arms to the patient followed by docking the robot after induction ,it greatly limits the access to patient especially arms and legs to the anaesthetist.Free flowing peripheral Iv and Extension tubings are required for infusion pumps. Central venous lines are very rarely placed.Arterial access only if needed.

Figure 4- Draped Patient With No Immediate Access To Patient Requiring Extension Tubings

Pneumoperitoneum Laparoscopic insufflation performed with carbon dioxide before robot arms docking as similar to a non robotic assisted laparoscopic surgery ,after positioning and securing the patient Insufflation done with co2 with as high as upto 20 cmH20 pressures for port placement but adjusted as per patient hemodynamic status upto 12-15cm H20 pneumoperitoneum induced hemodynamic changes like inceease in Systemic vascular resistance(SVR),Mean Arterial Pressure and Heart Rate were treated with increasing depth, opioids and beta blockers.After port placement steep trendlenberg position employed and robotic arms docked.

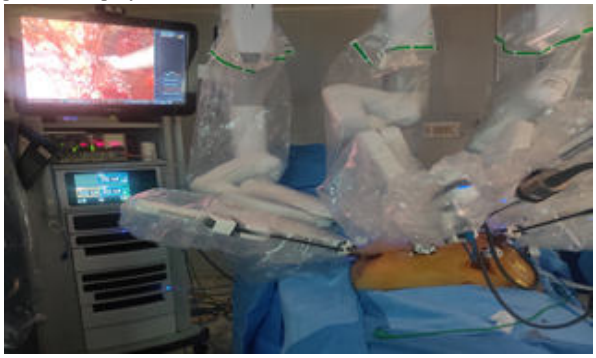


Figure -5 Pneumoperitoneum With Co2 And Docked In Robot Arms Limiting Patient Access

Pneumoperitoneum induces changes in Respiratory system like diaphragm migration reduced pulmonary compliance causing raised peak airway pressures and co2 induced hypercarbia were managed with ventilatory adjustment like increasing ventilation rate pressure controlled ventilation employed rarely newer ventilation modes like pressure control volume guarantee PC-VG have been used recently[5].

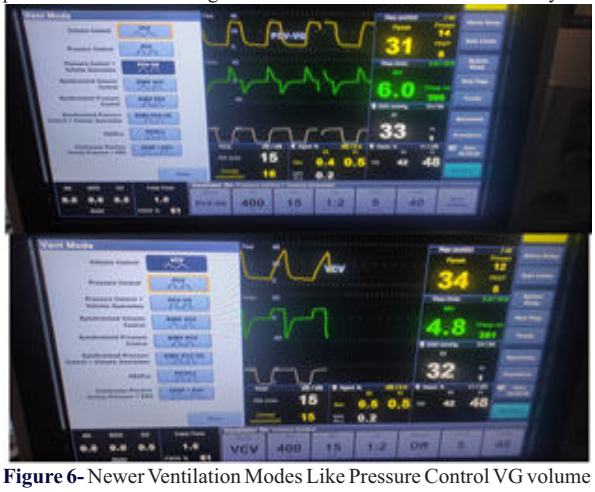


Figure 6- Newer Ventilation Modes Like Pressure Control VG volume guarantee delivering set tidal volume with lesser airway pressures.

Temperature
As Robotic equipments has to be maintained at lower temperature for their effective functioning operation theatre temperature is maintained as low as possible. wrapping the patient with multiple sheets on individual limbs along with warmer sheet with blow warmer is employed and it has given good results in temperature management.

Nasopharnygeal Temperature probe monitoring is done until the end of surgery. No patients faced hypothermia induced delayed emergence.

Figure 7 - Measures employed to counter hypothermia, long duration with multiple blanket covers, HME filter, and Hot line warmers.

Blood Loss
Blood loss is minimal in robotic assisted prostate surgery because of adequate exposure and access to the field.But blood loss may be overestimated due to open bladder urine.The number of blood transfusions done were very minimal and were only associated with coexisting anemia.

Fluid Restriction
Fluid administration is limited to around 1000ml to 2000ml litre because increased urine output obscures surgical field and trendlenberg position induced facial and airway edema and increased intracranial pressures.After initial replacement of fasting maintenance fluids fluid theraphy is restricted only as per blood loss and hemodynamics. once bladder anastomosis complete and patient made on 10° Head up and Iv replenishment done with crystalloids.colloids are used only on severe blood loss.

Urine Output Monitoring
As bladder is opened up urine output will not be collected and urine will be drained to the abdominal cavity which will be suctioned with blood resulting in false estimation of blood loss and difficulty to replace fluids based on urine output.

Hemodynamic Challenges
Arterial blood pressure monitoring is employed only if patient cardiovascular status requires.

Due to pneumoperitoneum and co2 insufflation Systemic vascular resistance increases and blood pressure control is achieved by increasing the depth of anaesthesia or drugs like Metoprolol, Esmolol Nitroglycerin infusion is avoided since it increases ICP in an trendlenberg positioned patient[7].

ANALGESIA
Central neuraxial blocks employed along with General anaesthesia has not been preffered because of requirement of early return of bowel function and early mobilization as per ERAS Protocol.

NSAIDS are avoided because patients being elderly with associated Comorbidities Fentanyl infusions are avoided because of elderly patients increased sensitivity.and it's given based on hemodynamic parameters as boluses Analgesia employed were Morphine at induction at 0.05mg at induction followed by fentanyl boluses or alpha 2 agonists like clonidine and Dexmedetomidine.

Regional Anaesthesia
Neuraxial blocks are avoided for earlier mobilization.ultrasound guided Transverse abdominis plane block or Qudratus Lumborum block adminstered with 0.375 % Ropivacaine 20ml each.

EXTUBATION
Once the bladder has been reanastomosed after prostate removal Propofol and Atracurium infusions are stopped and nitrous oxide is adminstered instead of air with oxygenated 10-30° reverse trendlenburg has been employed during Port closure.

All inhalatioanl agents stopped and plane block adminstered, Reversal of Atracurium done with neostigmine 50-70mcg/kg and Hyoscine (buscopan) to treat bladder spasm contractions along with antimuscarinic effects.

POSTOPERATIVE CONCERNS
In Post anaesthesia care unit fluid replacement done as per urine output as per hydration status.once shited out of PACU patient planned for early ambulation and clear. Tliquids given to favour return of bowel functions. Analgesia employed with paracetamol or Diclofenac. opioids like Tramadol is avoided to prevent paralytic illeus.DVT Prophylaxis and Triflowmetry exercises are employed as per ERAS protocol.

RESULTS
A Total of 200 patients retrospective data were collected.patient demographics ASA Status,Smoking history,Anaesthesia time,Robotic Dock time- from insufflation and docking,surgery to port closure, Ambulation, post op complications ,Total hospital stay days were collected.

The Mean (standard deviation) age group were 66.85±6.9 years,ASA STATUS 2 in 76% of patients,MEAN(SD) BMI 25.06±5.4 kg/m²Anaesthesia time 235.45±42.5 min, Robo Dock time 186.78±41.9 mins , Blood loss 201.45±69.94 ml of these patients smokers were around 33.5%,.

There were no incidence of on Table resuscitation ,termination of procedure in view of hemodynamics,higher airway pressures and no patients were reintubated on Table but few required post op diuretics and nebulization.

Frequencies
Table 1- Charecteristics Of Patients Who Undergone Robotic Prostate Surgeries

Statistics								
		Age	Height	Weight	BMI	Anaesthesia Time	Robot Dock time	Blood loss
N	Valid	200	200	200	200	200	200	200
	Missing	0	0	0	0	0	0	0
Mean		66.85	167.70	69.34	25.0613	235.45	186.78	201.45
Median		68.00	168.00	68.00	24.4500	240.00	180.00	200.00
Mode		65	165	60	22.00	240	180	150
Std. Deviation		6.975	6.992	10.442	5.41310	42.592	41.908	69.949
Minimum		49	150	48	16.70	160	10	100
Maximum		81	185	107	71.20	360	330	500

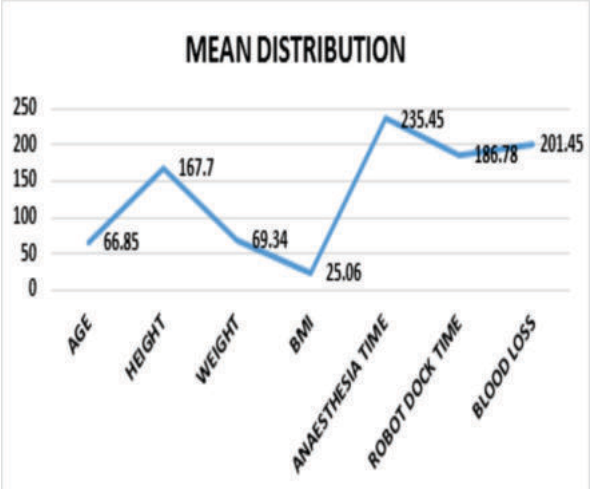


Figure 8- Mean Distribution Line Diagram For Patient Charecteristics.

Frequency Table

Table 2- Frequency Table For Asa Status.

ASA STATUS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	1.5	1.5	1.5
	2	152	76.0	76.0	77.5
	3	45	22.5	22.5	100.0
	Total	200	100.0	100.0	

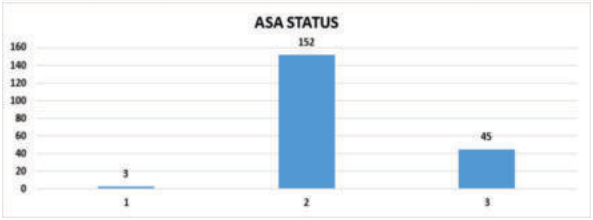


Figure 9- Bar Diagram For ASA Status

Table 3 - Smokers Frequency Table

SMOKER					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	133	66.5	66.5	66.5
	Yes	67	33.5	33.5	100.0
	Total	200	100.0	100.0	

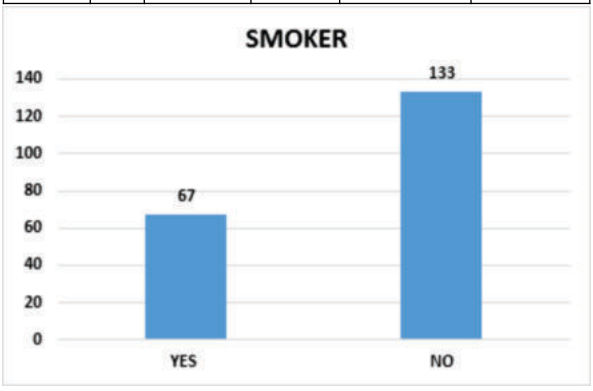


Figure - 10 Smoker Bar Diagram

Blood transfusions were required in 2% patients Around 78% patients were ambulated in Day 1 of surgery and Total duration of hospital stay were 2 days in 61.5% of patients.

Post op complications were Infection in 1 patient, Lymphocele in one patient 0.5%, septic shock in one patient urine leak in one patient.

Table 4- Ambulation Frequency Table

Ambulation					
Days		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	40	20.0	20.0	20.0
	1	156	78.0	78.0	98.0
	2	4	2.0	2.0	100.0
	Total	200	100.0	100.0	

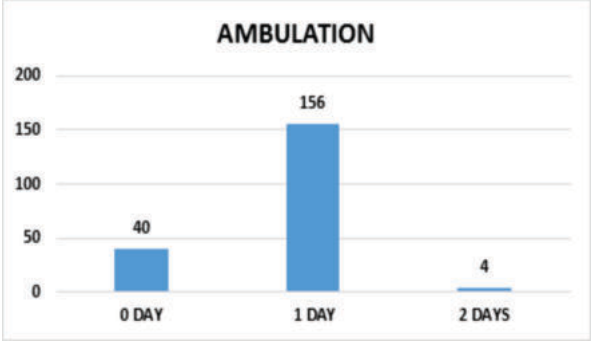


Figure 11- Bar Diagram For Ambulation

Table 5 - Frequency Table For Bowel Activity Return.

Bowel activity					
Days		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	157	78.5	78.5	78.5
	2	36	18.0	18.0	96.5
	3	6	3.0	3.0	99.5
	7	1	.5	.5	100.0
	Total	200	100.0	100.0	

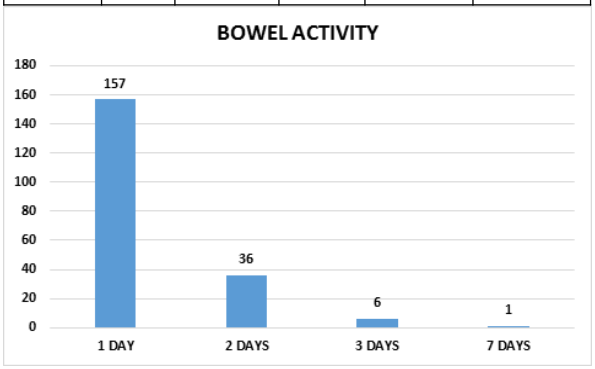


Figure 12- Bar Diagram For Bowel Activity Return.

FIT For Discharge

Table-6 Frequency Table For Discharge Criteria

Days		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	5.0	5.0	5.0
	1	101	50.5	50.5	55.5
	2	77	38.5	38.5	94.0
	3	8	4.0	4.0	98.0
	4	2	1.0	1.0	99.0
	6	1	.5	.5	99.5
	7	1	.5	.5	100.0
	Total	200	100.0	100.0	

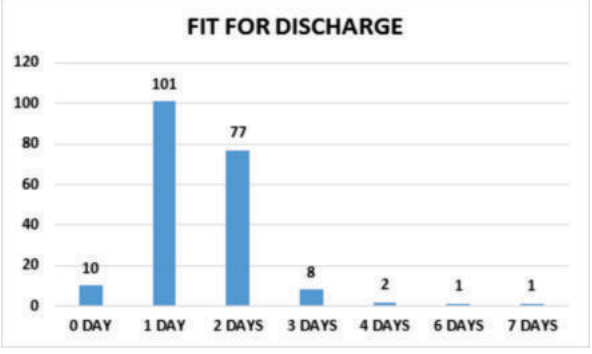


Figure - 13 Bar diagram for Frequency of Acheiving Fit for Discharge.

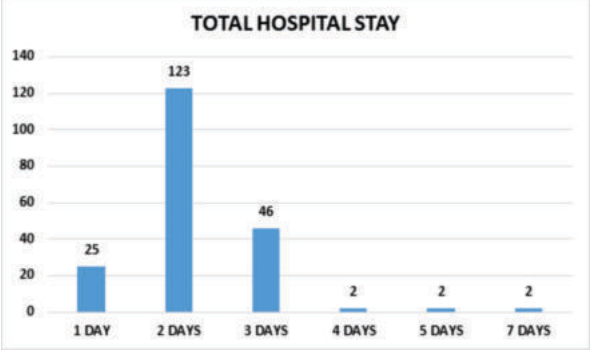


Figure -14 Bar Diagram For Total Hospital Stay

Table-7 Frequency Of Total Duration Of Hospital Stay.

Total hospital stay					
Days		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	25	12.5	12.5	12.5

	2	123	61.5	61.5	74.0
	3	46	23.0	23.0	97.0
	4	2	1.0	1.0	98.0
	5	2	1.0	1.0	99.0
	7	2	1.0	1.0	100.0
	Total	200	100.0	100.0	

Table 8 - Frequency Of Blood Transfusions.

Blood Transfusions					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	196	98	98	98
	YES	4	2.0	2.0	100.0
	Total	200	100.0	100.0	

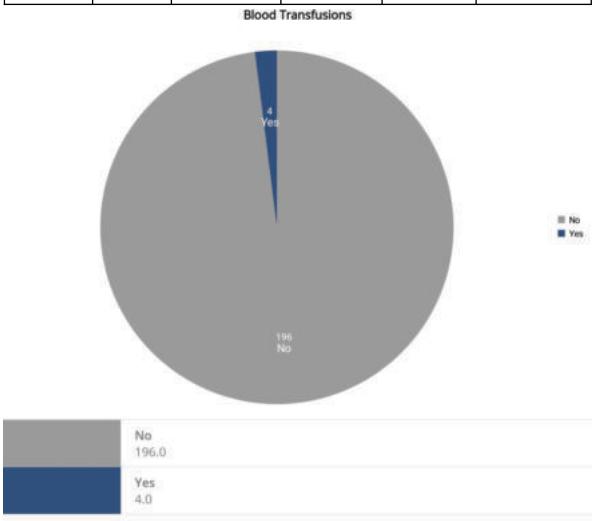


Figure -15 Pie Chart For Blood Transfusion

Table 9 - Frequency Of Post Op Complications.

Post op complications					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fluctuating Blood sugars	1	.5	.5	.5
	INFECTION	1	.5	.5	1.0
	Lymphocoele	1	.5	.5	1.5
	NIL	194	97.0	97.0	98.5
	septic shock	1	.5	.5	99.0
	Urine Leak	1	.5	.5	99.5
	ICU	1	.5	.5	100.0
	Total	200	100.0	100.0	

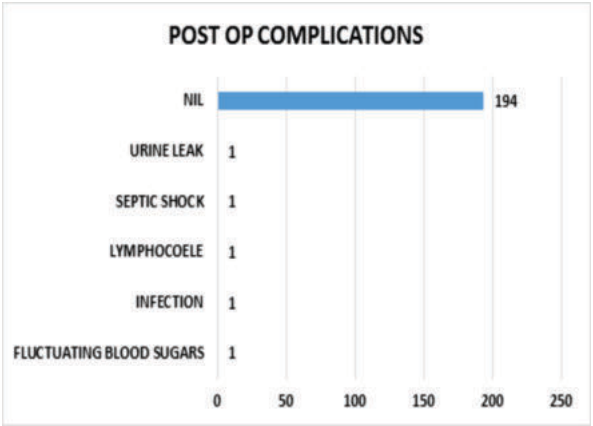


Figure 16 - Frequency Of Post Op Complications

DISCUSSION

Robotic-assisted prostate surgery has created new surgical options for the elderly, and its popularity is growing because it outcomes in faster recovery time, less blood loss, and a shorter length of stay when contrasted to open surgeries.[6]

Robotic Prostatectomy is accomplished with a pneumoperitoneum and a prolonged maximum Trendelenburg position, both of which can have negative physiological effects. The steep Trendelenburg position and pneumoperitoneum both have an effect on the respiratory system, increasing arterial CO2 and peak inspiratory pressures during mechanical ventilation. Pulmonary compliance and functional residual capacity are decreased, and the lungs are predisposed to compression atelectasis and ventilation/perfusion mismatch, both of which can result in hypoxia. Because of physiological factors, affiliated comorbidity, and the resources needed to perform safe surgery in these patients, anaesthetic management of the geriatric population is difficult[8]

Sufficient preoptimization, coordination, and multiple disciplines input enabled us to perform complex and long-term surgery in this group of high-risk patients with minimal complications, allowing for early discharge and mitigating critical care admission[9].

We used short duration induction and maintenance agents (propofol, sevoflurane, and fentanyl) to facilitate emergence from anaesthesia and minimised neuromuscular block doses to spontaneous ventilation efforts or increased airway pressures. fentanyl was used to suppress respiration, reduce stress response, and provide adequate analgesia alpha 2 agonists were also consideranbly used.

Fluid therapy was titrated to the patient's haemodynamic status due to minimal blood loss, and most patients received 1-2 L of crystalloids. There were four patients who needed blood transfusions.

There were no incident of terminating surgery in view of hemodynamics,high airway pressures,cardiac resuscitation and no patient were reintubated in operation Table post extubation and no incident of massive transfusion protocol activation.

CONCLUSION

Robotic prostatectomy surgeries has been the standard of treatment in cancer prostate.A Faster recovery, Minimal complications,early discharge can be With acheived Multidisciplinary input,Team work, Anaesthesiologist and surgeon communication incorpation of recent advances and strict application of ERAS Enhanced Recovery after surgery Protocols.[10][11]

Acknowledegments

Conflicts Of Interest: THE AUTHOR HAVE NO CONFLICTS OF INTEREST TO DECLARE.

Informed Consent: NOT APPLICABLE ,A RETROSPECTIVE DATA COLLECTION.NO IDENTITY OF THE PATIENTS WERE PUBLISHED.

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