Postoperative pulmonary complications in robot-assisted uro-oncological surgeries: Our experience in a tertiary cancer care centre

INTRODUCTION

Postoperative pulmonary complication (PPC) encompasses any respiratory complication after anaesthesia and surgery.[1] It has a significant negative impact on the perioperative outcome as it increases morbidity, mortality and length of hospital stay.[2] In major surgeries, the incidence of PPC varies between <1 and 23%[1] because of the heterogeneity in defining pulmonary complications in different works of literature. Though robot-assisted uro-oncological surgery has its advantages, the requirement of steep Trendelenburg position for a long period of time, CO_2 pneumoperitoneum and elderly patients with malignancy place this subset at risk of intraoperative hypoxia and postoperative atelectasis. The aim of this audit was to find out the incidence of PPC in robot assisted uro-oncological surgeries. Besides, any preoperative or intraoperative risk factor which could possibly precipitate the PPC had been taken into consideration.

METHODS

This retrospective review was conducted at a tertiary cancer care hospital following institutional review board waiver (IRB Waiver No: EC/WV/TMC/009/19). Patients who underwent robot-assisted uro-oncological surgeries from June 2017 to February 2019 were included. Sources of data were electronic and written medical records. Patients were reviewed until discharge.

Patients were considered to have PPC[1] if they had one or more of the following:

1. Antibiotics for suspected infection with one or more of the following: new or changed sputum, new or changed lung opacities, fever >38°C, white blood cell count >12 × 10^9/L
2. Ventilator dependence for >1 postoperative day or re-intubation
3. Need for postoperative mechanical ventilation >48 h
4. Requiring non-invasive ventilation (NIV)
5. Pleural effusion
6. Pneumothorax
7. Bronchospasm
8. Postoperative PaO_2 <8 kPa (60 mm Hg) in room air, a PaO_2:FIO_2 ratio <40 kPa (300 mm Hg), or arterial oxyhaemoglobin saturation measured with pulse oximetry <90% and requiring oxygen therapy
9. Pulmonary oedema

Assess Respiratory Risk in Surgical patients in Catalonia (ARISCAT) score was applied to categorise the patients into low (score 26), intermediate (score 26–44) and high (≥45) risk group.[3] The independent variables in ARISCAT score are low preoperative peripheral oxygen saturation (SpO_2 91–95% score 8, ≤90% score 24), respiratory infection in the last month (score 17), age (51–80 years score 3, >80 years score 16), preoperative anaemia (<100 g/dl score 11), intrathoracic/upper abdominal surgery (score 24/15), duration of procedure (2–3 h score 16, >3 h score 23), and emergency surgery (score 8).

Summary statistics were provided for each of the variables for PPC yes and PPC no group as the incidence of PPC was low. Since it was a retrospective audit where the sample size could not be predicted beforehand and the incidence came out to be low so no test of significance could be applied here. This is useful to show the trend only.

RESULTS

Seventy-two patients were reviewed during this audit. Patient characteristics (age, body mass index, sex, ASA status, ARISCAT score, acute respiratory tract infection within 1 month, asthma, COPD, hypertension, diabetes, obstructive sleep apnoea, urea >135 mg/dL, creatinine >1.5 mg/dL, abnormal liver function test, preoperative anaemia and albumin <3 g/dL) and intraoperative parameters (type of surgery, length of surgery, duration of anaesthesia, docking to undocking time, average peak airway pressure, maximum peak airway pressure, amount of fluid given, estimated blood loss, tidal volume, average respiratory rate and intraoperative blood transfusion) are enlisted in Table 1, most of which had been described as risk factors by Smetana and colleagues.[4] Two patients were excluded as they were converted to open procedure.

Among the 70 patients, only 3 (4.3%) patients had developed PPC. One of them required escalation of

Table 1: Patient characteristics and intraoperative parameters

Variable	Value	Variable	Value
Demographic Data		Preoperative investigations	
Age (years)	63 (57-68)	Abnormal LFT SGOT >120 IU/L, SGPT >140 IU/L, ALP >250 IU/L	1 (1.4)
BMI (kg/m^2)	24.6 (22.6-27.0)	Preoperative anaemia (haemoglobin <10 g/dL)	2 (2.9)
Male	60 (86)	Albumin <3 g/dL	0 (0)
Female	10 (14)	Intraoperative parameters	
ASA I	3 (4)	Total/partial nephrectomy	25 (35.7)
ASA II	44 (63)	Radical cystectomy/prostatectomy/both	45 (64.3)
ASA III	23 (33)		
ARISCAT Low	64 (91.4)	Length of surgery (min)	373.97±126.45
ARISCAT Intermediate	6 (8.6)	Duration of anaesthesia (min)	465.79±132.2
Comorbidities		Docking to undocking time (min)	245 (201-308)
Acute RTI within 1 month	5 (7.1)		
Asthma	7 (10)	Average peak airway pressure (cm H_20)	24.93±3.71
COPD	3 (4.3)	Maximum peak airway pressure (cm H_20)	30.89±4.17
Hypertension	49 (70)	Amount of fluid given (mL) total	2720±849
Diabetes	22 (31.4)	Estimated blood loss (mL)	250 (163-400)
OSA	3 (4.3)	Tidal volume (mL/kg of IBW)	8 (7-8)
Preoperative investigations		Average respiratory rate (breaths/min)	16 (15-18)
Urea >135 mg/dL	0 (0)		
Creatinine >1.5 mg/dL	0 (0)	Intraoperative blood transfusion (yes)	16 (22.9)

Values are in the median with IQR – Interquartile range, a number of patients (%) and mean±SD. ASA – American Society of Anesthesiologists, ARISCAT – Assess Respiratory Risk in Surgical patients in Catalonia, RTI – Respiratory tract infection, COPD – Chronic obstructive pulmonary disease, OSA – Obstructive sleep apnoea, LFT – Liver function test

antibiotic with NIV while another patient required mechanical ventilation for >1 postoperative day. The third patient required reintubation in ICU.

Patients who were smokers had recent acute respiratory tract infection or had any other co-morbidity (e.g., controlled asthmatics, COPD, OSA) did not develop pulmonary complications. The mean age, duration of surgery and anaesthesia, the average and maximum peak airway pressure were higher in PPC YES group. Docking to undocking time, which correlates with the duration of Trendelenburg position, was similar in both groups [Table 2].

This audit showed that length of hospital stay was higher in PPC yes group with the mean duration being 12 days while in PPC no group the same was 7 days.

DISCUSSION

PPCs adversely affect the perioperative outcome. Loss of central respiratory drive, airway obstruction, loss of diaphragmatic muscle tone, reduction of functional residual capacity, ventilation and perfusion mismatch and residual effects of anaesthetic agents are some of the anaesthetic contributory factors. Among the surgical factors, patient position, site of surgery, type of incision and intensity of postoperative pain contribute to the development of PPC.[1]

In this retrospective study, we observed that the incidence of PPC was 4.3%. In a previous study by Burks C *et al*., the incidence of PPC for robotic gynaecological surgeries was reported to be 2%.[5] The slightly higher incidence in our audit may have been due to the inclusion of elderly patients who underwent uro-oncological procedures only. Furthermore surgical and anaesthetic duration was higher in our cases. Old age,[6] malignancy[6] and prolonged surgical[4] and anaesthetic duration[7] have been found to be independent predictors of respiratory complications after surgery.

None of the patients who were smokers, had recent acute respiratory tract infection or had any other co-morbidity (e.g., controlled asthmatics, COPD, OSA) developed pulmonary complications. Even patients with intermediate ARISCAT grade, preoperative anaemia or those receiving intraoperative transfusion did not have PPC. This data supports the fact that robotic surgery is overall safe, even in patients with pre-existing pulmonary disease.

The average peak airway pressure was 30 cm of H_2O and the mean of maximum peak airway pressures had a value of 37 cm of H_2O in PPC YES group. Choi *et al*. noted that peak airway pressures ≥30 cm H_2O during laparoscopic colectomy was associated with a fivefold higher incidence of PPC.[8] The probable cause of high peak airway pressure in PPC YES group was

Table 2: Comparison of risk factors between PPC yes and PPC no group

Factors	PPC YES	PPC NO
Age (years)	65.67±3.06	61.46±9.4
BMI (kg/m^2)	27.21±1.09	24.72±3.90
Respiratory tract infection within 1 month	0 (0)	5 (7.5)
Asthma	0 (0)	6 (9)
Chronic Obstructive pulmonary disease	0 (0)	3 (4.5)
Smoking	0 (0)	10 (15)
Hypertension	3 (100)	46 (68.7)
Diabetes	2 (66.72)	20 (29.9)
Obstructive sleep apnoea	0 (0)	3 (4.5)
Preoperative anaemia	0 (0)	2 (3)
ARISCAT score	26±0	26.46±4.94
ARISCAT low	3 (100)	61 (91)
ARISCAT intermediate	0 (0)	6 (9)
ARISCAT high	0 (0)	0 (0)
Perioperative NG tube	2 (66.7)	55 (82.1)
Length of surgical procedure (min)	415±75.5	372.13±129.25
Anaesthetic duration (min)	520±60.83	463.36±135.22
Docking to undocking time (min)	266.67±55.08	263.58±106.4
Tidal volume/kg	7.52±1.02	7.69±1.1
Average peak airway pressure (cm H_2O)	30.33±5.69	24.69±3.5
Maximum peak airway pressure (cm H_2O)	37.33±6.43	30.6±3.9
Amount of fluid given total (mL)	2733.33±945.16	2719.4±859.04
Intraoperative transfusion	0 (0)	16 (23.9)
Steep Trendelenburg	2 (66.7)	39 (58.2)

Values are in mean±SD, no of patients (%). BMI – Body mass index, ARISCAT – Assess Respiratory Risk in Surgical patients in Catalonia

higher intraabdominal pressure which was required for better surgical access or control of bleeding. Length of hospital stay was longer in the affected patients. So PPC pushed up the in-hospital morbidity as was also found by Smith PR *et al*.[2]

Our patients were anaesthetised and operated by anaesthesiologists and surgeons with various levels of expertise. We included multiple criteria for defining PPC from different works of literature and the patients were followed up till the day of discharge.

There were certain limitations in our audit. As the incidence rate of PPC is low compared to the sample size in our study group, it would have been erroneous to apply any test of significance to our data. We were unable to incorporate intraabdominal and plateau airway pressure measurement in our data as those were not routinely documented.

CONCLUSION

This audit has shown a low rate of PPC. It would be reasonable to infer that robot-assisted uro-oncological surgery is safe in terms of PPCs. A prospective study with more patients incorporating measured peak and plateau airway pressure and simultaneous intraabdominal pressure recording does have the potential to guide us to the real answer.

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Conflicts of interest

There are no conflicts of interest.

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