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**ORIGINAL RESEARCH**

# Assessment of physiological changes between transperitoneal and retroperitoneal approach for urologic laparoscopic surgery

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**ABSTRACT**

**Background:**The benefits of laparoscopy as compared to open surgery, include reduced postoperative pain, minimal scarring, quick recovery, and short convalescence. The present study was conducted to compare physiological changes between transperitoneal and retroperitoneal approach for urologic laparoscopic surgery.

**Materials & Methods:**50 healthy individuals undergoing elective urologic laparoscopic surgeries of both genderswere divided into 2 groups of 25 each divided into two groups according to the surgical approach used. Group I patients underwent transperitoneal (Trans) and group II underwent retroperitoneal (Retro) approach.Compliance, peak inspiratory pressure (PIP), minute ventilation (MV), heart rate (HR) and mean arterial pressure (MAP) were monitored at defined time interval. Arterial blood gases were also measured to compare partial pressure of arterial oxygen/fraction of inspired oxygen (PaO2 /FiO2) ratio.

**Results:**T h e mean age was 42.5±2.3 years in group I and 46.2±4.2 years in group II. The mean weight was 57.4±7.5 kgs in group I and 53.1±7.6 kgs in group II. Duration of surgery (mins) was 254.2±17.4 in group I and 202.8±14.5 in group II. Lateral positions (right/left)was seen in 14:11 and 10:15 and duration of CO2 insufflation (mins) was 192.4±18.3 in group I and 170.6±12.1 in group II. The difference was non- significant (P> 0.05). Surgery performed were simple nephrectomy in 12 and 10, donor nephrectomy in 0 and 7, partial nephrectomy in 0 and 2, radical nephrectomy in 8 and 2, pyeloplasty in 5 and 0 and ureterolithotomy in 0 and 4 in group I and II respectively. The difference was significant (P< 0.05).P/F ratio at baseline was 394.2±11.5 and 400.5±24.1, P/F ratio at the end was 430.5±25.2 and 352.4±37.4, PaCO2 -EtCO2 difference at baseline was 4.7±1.1 and 4.2±1.9 and PaCO2 -EtCO2 difference at the end was 6.3±2.3 and 8.1±2.1 in group I and II respectively. The difference was significant (P< 0.05).

**Conclusion:** Respiratory and haemodynamic parameters are stable and comparable between the two approaches.

**Keywords:** Arterial blood gases, laparoscopic surgery, ureterolithotomy



## Introduction

The benefits of laparoscopy as compared to open surgery, include reduced postoperative pain, minimal scarring, quick recovery, and short convalescence.[1] Consequently, a variety of renal procedures—such as simple nephrectomy, living donor nephrectomy, partial or radical nephrectomy, and pyeloplasty—are being performed laparoscopically with greater frequency, utilizing either the transperitoneal or retroperitoneal approach. Although the retroperitoneal approach offers benefits like safe port placement and reduced manipulation of abdominal viscera, it can be technically challenging due to its smaller working space and closer port placement compared to the transperitoneal approach.[2]

There has been considerable research into physiological changes during laparoscopy. Only a small number of studies have examined the effects of laparoscopy performed via either the transperitoneal or retroperitoneal approach. According DemirolukS et al[3], the retroperitoneal approach demonstrated greater absorption of Carbon Dioxide (CO2). Another research conducted by Ng CS et al[4] found that retroperitoneoscopic surgery was not linked to heightened CO2 absorption. In the study by Nadu A et al[5], it was found that the retroperitoneal approach had

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a lesser impact on ventilatory and haemodynamic functions. However, Baird JE et al[6] discovered that the effects of CO2 insufflation on haemodynamics and partial pressure of CO2 were identical in both retroperitoneal and intraperitoneal spaces. In most of these studies with varying outcomes, the patient population, type of surgery, and surgical positions were not comparable between the groups being compared.The present study was conducted to compare physiologicalchanges between transperitoneal and retroperitoneal approach for urologic laparoscopic surgery.

## Materials & Methods

The study was carried out on 50 healthy individuals undergoing elective urologic laparoscopic surgeries of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups of 25 eachdivided into two groups according to the surgical approach used. Group I patients underwent transperitoneal (Trans) and group II underwent retroperitoneal (Retro) approach.Compliance, peak inspiratory pressure (PIP), minute ventilation (MV), heart rate (HR) and mean arterial pressure (MAP) were monitored at defined time interval. Arterial blood gases were also measured to compare partial pressure of arterial oxygen/fraction of inspired oxygen (PaO2 /FiO2) ratio.Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

## Results

**Table: I Demographic data**

| Data | Group I | Group II | P value |
|---|---|---|---|
| Age (years) | 42.5±2.3 | 46.2±4.2 | 0.91 |
| Weight (kg) | 57.4±7.5 | 53.1±7.6 | 0.85 |
| Duration of surgery (mins) | 254.2±17.4 | 202.8±14.5 | 0.72 |
| Lateral positions (right/left) | 14:11 | 10:15 | 0.05 |
| Duration of CO2 insufflation (mins) | 192.4±18.3 | 170.6±12.1 | 0.14 |

Table I shows that mean age was 42.5±2.3years in group I and 46.2±4.2years in group II. The mean weight was 57.4±7.5kgs in group I and 53.1±7.6 kgs in group II. Duration of surgery (mins) was 254.2±17.4in group I and202.8±14.5in group II. Lateral positions (right/left)was seen in 14:11 and 10:15 and duration of CO2 insufflation (mins) was 192.4±18.3in group I and 170.6±12.1in group II. The difference was non- significant (P> 0.05).

**Table: II Type of surgery**

| Surgery | Group I | Group II | P value |
|---|---|---|---|
| Simple nephrectomy | 12 | 10 | 0.05 |
| Donor nephrectomy | 0 | 7 | |
| Partial nephrectomy | 0 | 2 | |
| Radical nephrectomy | 8 | 2 | |
| Pyeloplasty | 5 | 0 | |
| Ureterolithotomy | 0 | 4 | |

Table II, graph I shows that surgery performed were simple nephrectomy in 12 and 10, donor nephrectomy in 0 and 7, partial nephrectomy in 0 and 2, radical nephrectomy in 8 and 2, pyeloplasty in 5 and 0 and ureterolithotomy in 0 and 4 in group I and II respectively. The difference was significant (P< 0.05).

**Graph I Type of surgery**

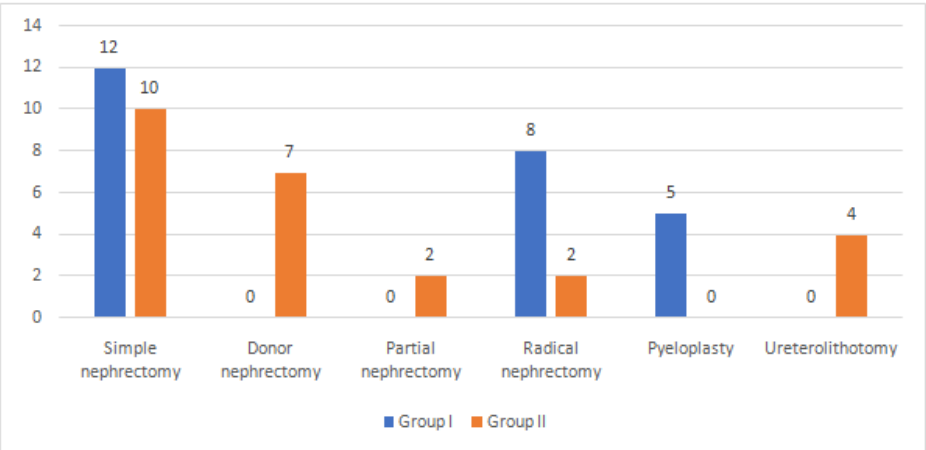

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**Table: III Assessment of parameters**

| Parameters | Group I | Group II | P value |
|---|---|---|---|
| P/F ratio baseline | 394.2±11.5 | 400.5±24.1 | 0.12 |
| P/F ratio at the end | 430.5±25.2 | 352.4±37.4 | 0.01 |
| PaCO2 -EtCO2 difference baseline | 4.7±1.1 | 4.2±1.9 | 0.37 |
| PaCO2 -EtCO2 difference at the end | 6.3±2.3 | 8.1±2.1 | 0.48 |

Table III shows that P/F ratio at baseline was 394.2±11.5 and 400.5±24.1, P/F ratio at the end was 430.5±25.2 and 352.4±37.4, PaCO2 -EtCO2 difference at baseline was 4.7±1.1 and 4.2±1.9 and PaCO2 -EtCO2 difference at the end was 6.3±2.3 and 8.1±2.1 in group I and II respectively. The difference was significant (P< 0.05).

**Discussion**

Pneumoperitoneum impacts the different organ systems through physical pressure on these systems as well as through the systemic absorption of CO2.[7,8] Due to the rise in intra-abdominal pressure, the diaphragm becomes splinted and shifts cephalad, causing a reduction in functional residual capacity, lung compliance to decline, and an increase in Ventilation/Perfusion ratio (V/Q) mismatch across various lung regions, with nondependent areas receiving preferential ventilation. The result is compromised oxygenation and ventilation, which can lead to hypoxia and hypercarbia, respectively.[9] The fundamental distinctions between the two methods concerning anaesthesia are as follows: surface area exposure, lateral positioning, and pneumoperitoneum pressure affecting one or both diaphragms.[10]The present study was conducted to compare physiological changes between transperitoneal and retroperitoneal approach for urologic laparoscopic surgery.

We found that mean age was 42.5±2.3 years in group I and 46.2±4.2 years in group II. The mean weight was 57.4±7.5 kgs in group I and 53.1±7.6 kgs in group II. Duration of surgery (mins) was 254.2±17.4 in group I and 202.8±14.5 in group II. Lateral positions (right/left)was seen in 14:11 and 10:15 and duration of CO2 insufflation (mins) was 192.4±18.3 in group I and 170.6±12.1 in group II. Shah et al[11]compared physiological changes that occurred whenurologic laparoscopic surgeries were carried out through eithertransperitoneal or retroperitoneal approach in lateral positions.46 healthyindividuals undergoing elective urologic laparoscopic surgerieswere divided into two groups according to thesurgical approach used: 1) Transperitoneal (Trans) group; and2) Retroperitoneal (Retro) group. PaO2/FiO2ratio improved in Trans (from 395.45±128.35to 439.88±87.77) and decreased in Retro group (from399.29±57.6 to 349.72±97.89) at the end of pneumoperitoneumwith significant statistical difference between the two groups.Compliance decreased to 37% of baseline (from 33.03 to 20.99mL/cm H2O in Trans group and from 37.02 to 23.23 mL/cmH2O in Retro group) and PIP increased to 45% from baseline(from 18.43 to 26.13 cm H2O in Trans group and from 17.91 to25.86 cm H2O in Retro group) in both the groups without anystatistical difference. The HR remained higher in Trans groupas compared to Retro group during the insufflation period. TheMAP remained higher than baseline during pneumoperitoneumin both the groups. Statistical comparison of HR and MAPbetween the two groups was insignificant.

We found that surgery performed were simple nephrectomy in 12 and 10, donor nephrectomy in 0 and 7, partial nephrectomy in 0 and 2, radical nephrectomy in 8 and 2, pyeloplasty in 5 and 0 and ureterolithotomy in 0 and 4 in group I and II respectively. Taue R et al[12]compared perioperative outcome of transperitoneal and retroperitoneal approaches during laparoscopic radical nephrectomy (LRN) and to identify selection criteria for each approach.100 consecutive patients underwent LRN for a renal tumor with clinical stage T1a-T3a. The first choice approach was retroperitoneal. The transperitoneal approach was chosen in selected cases based on tumor characteristics. Thirty-three patients underwent the transperitoneal approach, and 67 had the retroperitoneal approach. Overall, 33 transperitoneal laparoscopic radical nephrectomies (TLRN) and 67 retroperitoneal laparoscopic radical nephrectomies (RLRN) were carried out. There was a statistically significant difference between the two groups in terms of size (5.3 vs 3.0 cm, P < 0.0001) and clinical T stage (higher in the TLRN group, P < 0.0001) of the tumors. Intraoperative complications included bradycardia, pneumothorax, renal vein injury, and renal artery injury in the TLRN group, and pneumothorax in the RLRN group. There were no differences in terms of operative time, blood loss and tumor grade between the two groups.

We found that P/F ratio at baseline was 394.2±11.5 and 400.5±24.1, P/F ratio at the end was 430.5±25.2 and 352.4±37.4, PaCO2 -EtCO2 difference at baseline was 4.7±1.1 and 4.2±1.9 and PaCO2 -EtCO2 difference at the end was 6.3±2.3 and 8.1±2.1 in group I and II respectively. Fujise K et al[13] in their study studied whether a difference in the side of lateral position affected hemodynamic and pulmonary functions during pneumoperitoneum. 15 patients (8 in the right and 7 in the left lateral position) undergoing elective laparoscopic urological surgery were studied under general anesthesia. Hemodynamic variables and blood gas data were recorded. Before insufflation, mean arterial pressure (MAP), mean pulmonary arterial pressure (MPAP), central venous pressure (CVP), and pulmonary capillary wedge pressure (PCWP) in the right lateral position were higher than

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those in the left lateral position. Pneumoperitoneum increased MAP, MPAP, CVP, PCWP, and cardiac index but decreased systemic vascular resistance in the right lateral position. Similar changes occurred during pneumoperitoneum in the left lateral position, but the changes were less than those in the right lateral position. The respiratory index (PaO2/PAO2), intrapulmonary shunt, and SpO2 did not change during pneumoperitoneum in either lateral position. Changing the side of the lateral position affected hemodynamic function but did not affect pulmonary oxygenation during pneumoperitoneum.
The shortcoming of the study is small sample size.

## Conclusion

Authors found that respiratory and haemodynamic parameters are stable and comparable between the two approaches.

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