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Effect of Surgery on Pulmonary Functions. A Prospective Study.

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Abstract
Background*: Upper abdominal surgical procedures are associated with a high risk of postoperative pulmonary complications (PPCs), which are defined as pulmonary abnormalities occurring in postoperative period which produce clinically significant, identifiable disease or dysfunction that adversely affects the patients' clinical course. Despite recent advances in preoperative management, postoperative respiratory morbidity is still a common problem especially following upper abdominal surgery. To study the risks of postoperative complications, a pre-operative medical evaluation of the patients was done by performing pulmonary function test both pre and post operatively and changes on them were studied to predict and reduce morbidity, mortality and length of hospital stay in patients.*
Aim: *To see the impact of upper abdominal surgeries on post-operative lung function in elderly patients with approximate time to recover from such a deterioration in pulmonary function.*
Methods: *We performed a randomly controlled prospective hospital study for 2 years, including eighty patients. Patients ≥ 60 years of age were taken randomly of both the sexes which were of ASA status 2 to 3 , planned for elective, non-laparoscopic, upper abdominal surgeries(cholecystectomy or gastrectomy). The selected individuals were subjected to spirometry preoperatively. After surgery and proper recovery from the anesthesia Spirometry was again carried out in the post-operative period on the first and second post-operative days as was done pre-operatively and the changes in their lung functioning tests were noted.*
Results: *In our study FVC, FEV1 and FEV1/FVC were studied preoperatively and on the first and second post operative day following upper abdominal surgeries. There is significant fall in FVC, FEV1 and FEV1/FVC i.e lung fuction tests on the first and second post operative day following upper abdominal surgeries , the fall being more on first post operative day than the second . However, an ismprovement in all the parameters of pulmonary function was observed beyond the second postoperative day.*
Conclusion: *Following upper abdominal surgeries , there is fall in FVC, FEV1 and FEV1/FVC fall being more on first post operative day than the second. Lung spirometry allows patients with pulmonary abnormality to be objectively screened and could be useful for predicting operative risk related to abnormal pulmonary function and reduce morbidity, mortality and length of hospital stay in patients.*
Keywords: *lung volumes , Spirometry ,ventilation patterns , elective upper abdominal surgery.*

I. Introduction

Postoperative pulmonary complications is defined as, pulmonary abnormalities occurring in the postoperative period that produce clinically significant, identifiable disease or dysfunction adversely affecting the patients' clinical course.[1] Despite recent advances in preoperative management, postoperative respiratory morbidity is still a common problem especially following upper abdominal surgery[2]. It leading frequently to increased morbidity, mortality and lengthy hospital stay.[3] The incidence rate of postoperative pulmonary complications depends on the surgical site, the presence of risk factors, and the criteria used to define a postoperative pulmonary complication.[4] Pulmonary complications include atelectasis, pneumonia, respiratory failure and tracheobronchial infections. The commonest of these complications is pulmonary atelectasis, though pneumonia is considered to be the main cause of mortality, seperately incidence of atelectasis ranges from 20% to 69% and postoperative pneumonia from 9% to 40%.[5] The basic mechanism of postoperative pulmonary complications is a lack of lung inflation that occurs because of a change in breathing to a shallow, monotonous pattern without periodic sighs, prolonged recumbent positioning and temporary diaphragmatic dysfunction along with Mucociliary clearance impairment postoperatively.[6] There are broadly three risk factors, which can possibly lead to the development of pulmonary complications postoperatively i.e **Patient-Related** (Age ≥60 years, ASA class ≥II**,** Heart failure , Chronic obstructive pulmonary disease**,** Alcohol use) **Procedure-Related (**Thoracic surgery**,** Abdominal surgery**,** Neurosurgery**,** Use of general anesthesia) and **Laboratory Test–Related** (Albumin level <35 g/L **,** Abnormal chest radiograph**,** BUN level >7.5 mmol/L (>21 mg/dL).[7] A preoperative anaesthetic evaluation enables clinicians to accomplish two distinct yet related goals.

1) To predict the risk of perioperative complications, and
2) To eliminate or reduce the risk of complications perioperatively

The first goal is usually accomplished by careful history taking and examination of patients and through risk assessment indices that predict the incidence of complications. The second goal is accomplished through preoperative and perioperative risk reduction interventions.

Perioperative changes in lung volumes and ventilation patterns can lead to hypoxemia and atelectasis.[8] Duration, route of administration and the type of anaesthesia are significant riskfactors for postoperative pulmonary complications. [9] COPD, pneumonia, and sleep apnoea are common in the elderly hence age is a vital factor. Preoperative screening of pulmonary disease is a must, spirometry allows patients with pulmonary abnormality to be objectively screened, and could be useful for predicting operative risk related to abnormal pulmonary function.[10] One important study shows an increased risk of PPCs among abdominal surgical patients with abnormal spirometry.[11] In spite of major limitations, including small sample size, lack of standard definitions for PPCs, and no blinding of outcome assessments, several subsequent studies recommend preoperative PFTs for patients undergoing elective abdominal surgery.[12] The pulmonary status of patients with recent exacerbations or infections should be allowed to improve whenever possible. Administration of antibiotics, bronchodilators, and steroids, referral to pulmonologists or internists, and postponing surgery are important in patients at high risk. Training patients preoperatively in lung expansion manoeuvres, such as deep-breathing exercises and incentive spirometry, reduces pulmonary complications more than training postoperatively does. Additionally, a change in perioperative management, including altering the planned surgical procedure if possible, discussing alternatives to general anaesthesia, especially when peripheral nerve blocks are an option, and educating the patient about the benefits of epidural pain management, may provide effective measures to decrease pulmonary complications.[13]

II. Methods

A hospital based prospective observational study was conducted at the Government Medical College, Srinagar. After obtaining approval from Hospital Ethics Committee, a written informed consent was taken from the patients for participation in this study. Eighty patients were included in the study. The selected individuals were subjected to spirometry .

Inclusion criteria

(1) Patients ≥ 60 years of age were taken for the study.
(2) Patients of both the sexes were selected.
(3) Patients with ASA status 2 to 3 were included.
(4) Patients planned for elective, non-laproscopic, upper abdominal surgeries(cholecystectomy or gastrectomy) were included.
(5) Patients were included randomly.

Exclusion criteria

(1) Unstable cardiovascular status(heart blocks, dysrhythmias, heart block, recent MI)
(2) Recent cerebrovascular event , increased intracranial pressure, impaired cognitive function
(3) known COPD and bronchial asthma patients
(4) Chemotherapy patients

Study Design And Conduct: Patients selected for the study were admitted atleast 24 hours prior to the planned surgical procedure. An informed consent was taken from the participants found fit for the study. A pre-anaesthetic evaluation was done at this stage. A thorough history including history of any co-morbid diseases, previous anaesthetic exposure, medications, allergy to any drugs and personal habits were elicited. A thorough general physical examination including airway assessment, as well as systemic examination of cardiovascular system, respiratory system and central nervous system were performed. All the baseline parameters (like weight, height, vitals) were measured. A preoperative spirometry was performed in all the selected persons as per ATS recommendations, using a portable bed side spirometer, atleast 24 hours prior to proposed surgery .

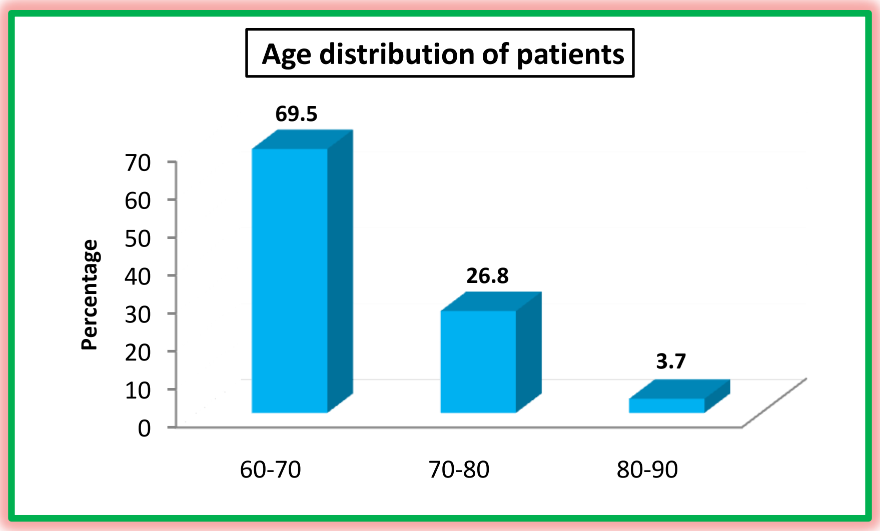
Spirometry: The spirometer used during the study was RMS Helios 401 spirometer made by Recorders & Medicare systems (P) LTD. The spirometer fulfilled ATS and ERS criteria for accuracy and precision. The spirometry was performed according to the guidelines prescribed in the American Thoracic Society (ATS) and ERS guidelines. Spirometry was not performed on participants who had any of the contraindications for performing spirometry. Variables used in this study and there meanings:

Forced Vital Capacity (FVC): The maximal volume of air exhaled with maximally forced effort froma position of maximal inspiration.
Forced Expiratory Volume in one Second (FEV1): The volume of air expelled in the first second of the FVC maneuver.
FEV1/FVC% (Also called FEV1/FVC ratio): It is calculated by dividing the patients' largest FEV1 by the patients' FVC and multiplied by 100.
Peak Expiratory Flow Rate (PEFR): Largest expiratory flow achieved with maximally forced effort from a position of maximal inspiration.
FEF25-75%: Mean Forced Expiratory Flow during the middle half of the FVC. Formerly it was called the maximal mid-expiratory flow (MMEF).
Anaesthetic procedure was standardized for the study group. Patients were induced with inj. Propofol 2mg/kg, muscle relaxation was accomplished with inj. Atracurium 0.5mg/kg, and anaesthesia was maintained with Oxygen, Nitrous Oxide and Isoflurane. For maintenance of intraoperative muscle relaxation inj. Atracurium 0.2mg/kg was used. For analgesia, intraoperatively patients were given inj. Tramadol 1mg/kg IV, inj. Paracetamol 1gm IV infusion, and local infiltration with bupivacaine 0.25% at the incision site. At the end of the surgical procedure, residual neuromuscular blockade was antagonized with inj. Neostigmine 50μg/kg IV and inj. Glycopyrrolate 10μg/kg IV.
Spirometry was again carried out in the post-operative period on the first and second post-operative days as was done pre-operatively. No rescue analgesia was used, and patients with pain score of >4 on VAS scale were excluded from the study. Student's independent t-test was employed for inter group analysis of data. Intra group analysis was carried out with the help of Paired t-test. Significant values were taken if the p-value was less than 0.05. SPSS was used as a software tool for the analysis of the data.

III. Results

Table 1: Age distribution of patients

Age (years)	**No.**	**Percentage**	**Mean±SD**	**Range**
60-70	57	69.5	65.1±6.31	60-85
70-80	22	26.8		
80-90	03	3.7		
Total	82	100		

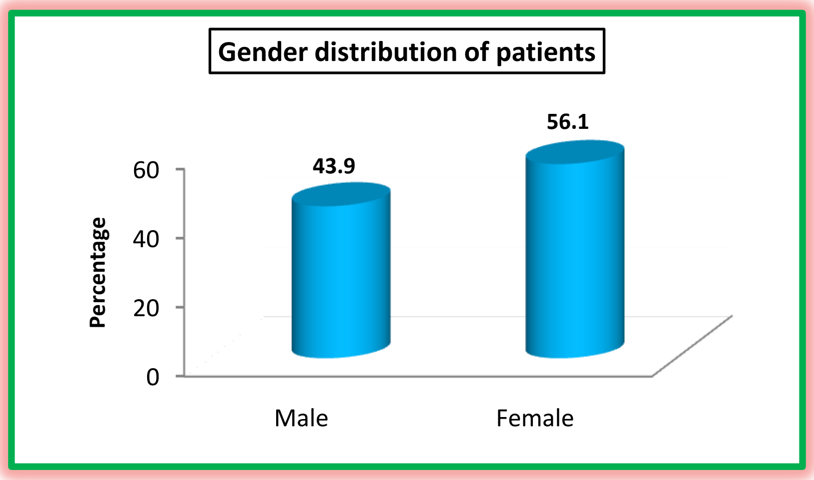


Fig; 1

The total number of individuals in the studied population were 82, age ranging from 60-85 years and mean age 65.1±6.31years. The total number of individuals in 60-70 years age group were 57 (69.5%). In the age group of 70-80 years, total number of individuals were 22 (26.8%). In the age group 80-90 years the number of individuals were 03(3.7%) as shown in table 1 and fig 1.

Table 2: Gender distribution of patients

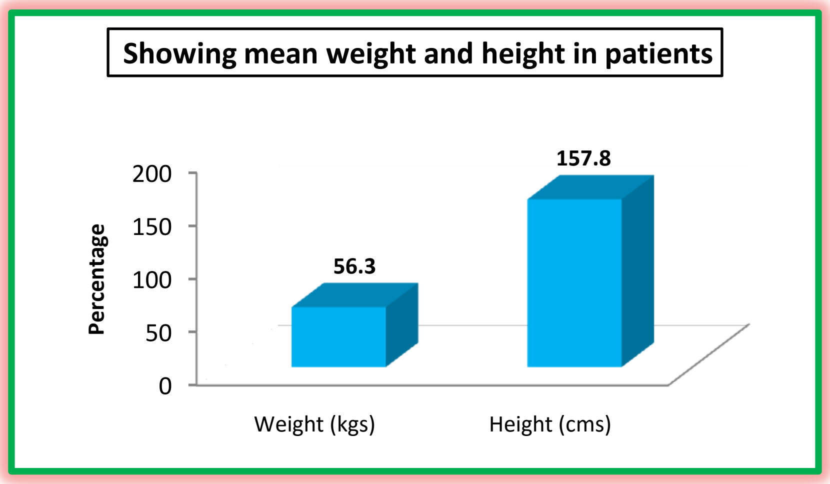
Gender	**No.**	**Percentage**
Female	46	56.1
Male	36	43.9
Total	82	100



Fig; 2

The total number of individuals in the studied population were 82, among which there were 46 (56.1%) females and 36(43.9%) males, with a male female ratio of 0.78 as in table 2 and fig 2.

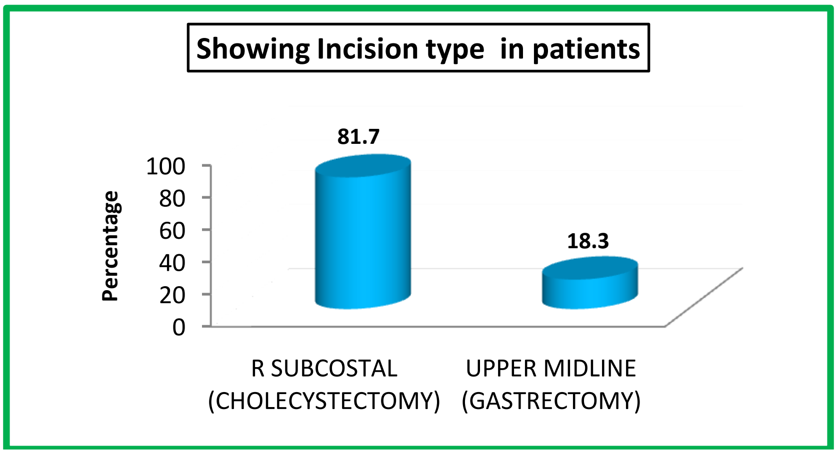
Table 3: Showing mean weight and height in patients			
Variable	**Mean**	**SD**	**Range**
Weight (kgs)	56.3	7.09	40-74
Height (cms)	157.8	11.15	144-193



Fig; 3

The mean weight of the studied population was 56.3±7.09kgs (Range=40-74 kgs), and the mean height of the studied population was 157.8±11.15cms (Range=144-193 cms) as in table 3 and fig 3.

Table 4: Showing type of Surgical Incision in patients		
Type of Surgery/ incision	**No.**	**Percentage**
Cholecystectomy (R. subcostal incision)	67	81.7
Gastrectomy (Upper mid-line incision)	15	18.3



Fig; 4

Of the 82 patients in the study group 67 (81.7%) patients were subjected to Open cholecystectomy using right subcostal incision and 15 (18.3%) were subjected to Gastrectomy via an upper midline incision as in table 4 and fig 4.

Table 5: Comparison of Changes in FVC in all patients

Time Interval	**Mean**	**SD**	**Diff.**	**Δ**	**P-value**
Preop	2.24	0.509	-	-	-
Postop Day 1	1.12	0.283	1.12	47.5	<0.001*
Postop Day 2	1.42	0.286	0.82	34.3	0.002*

Δ: Percentage fall in FVC from Preoperative FVC

***Statistically Significant Difference from preoperative FVC**

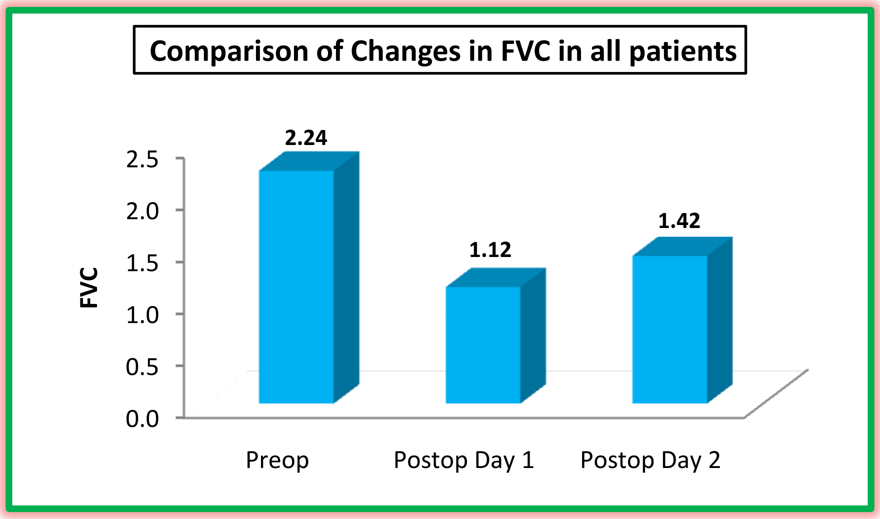


Fig 5

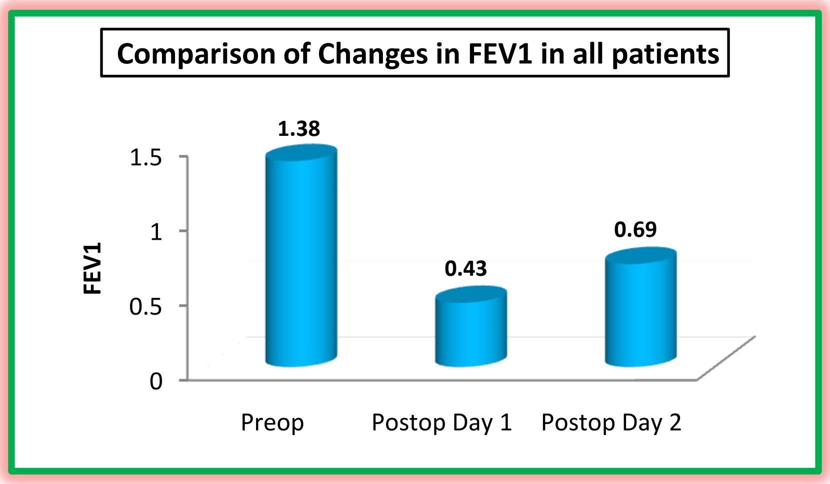
The mean preoperative Forced Vital Capacity (FVC) was 2.24± 0.509L. Mean Postoperative Forced Vital Capacity (FVC) was 1.12±0.283L and 1.42± 0.286L on first and second postoperative days respectively. The mean fall in the FVC was 47.5% and 34.3% on first and second postoperative days, a statistically significant fall(P-value of <0.001 and 0.002 respectively) as in table 5 and fig 5.

Table 6: Comparison of Changes in FEV_1 in all patients

Time Interval	**Mean**	**SD**	**Diff.**	**Δ**	**P-value**
Preop	1.38	0.370	-	-	-
Postop Day 1	0.43	0.111	0.95	67.4	<0.001*
Postop Day 2	0.69	0.162	0.69	47.6	<0.001*

Δ: Percentage fall in FEV1 from Preoperative FEV1

***Statistically Significant Difference from preoperative FEV1**



Fig; 6

Table 6 and fig. 6 depict the mean preoperative Forced Expiratory Volume in one second (FEV_1) was 1.38±0.370L. The mean postoperative $FEV_1$was 0.43± 0.111L and 0.69±0.162L on first and second postoperative days respectively. There was a 67.4% fall in FEV_1 on the first postoperative day and 47.6% fall in FEV_1 on the second postoperative day, a statistically significant fall (P-value <0.001).

Table 7: Comparison of Changes in FEV_1/FVC in all patients

Time Interval	**Mean**	**SD**	**Diff.**	**Δ**	**P-value**
Preop	82.78	11.83	-	-	-
Postop Day 1	54.26	13.21	28.52	33.6	<0.001*
Postop Day 2	66.84	11.26	15.94	18.3	0.0034*

Δ: Percentage fall in FEV1/FVC from Preoperative FEV1/FVC
***Statistically Significant Difference from preoperative FEV1/FVC**

The mean preoperative FEV_1/FVC was 82.78±11.83%. Mean postoperative FEV_1/FVC was 54.26±13.21% and 66.84±11.26% on first and second postoperative days respectively. The percentage fall in the FEV_1/FVC was 33.6% and 18.3% respectively (P-value <0.001 and 0.0034 respectively) as depicted in table 7 and fig 7.

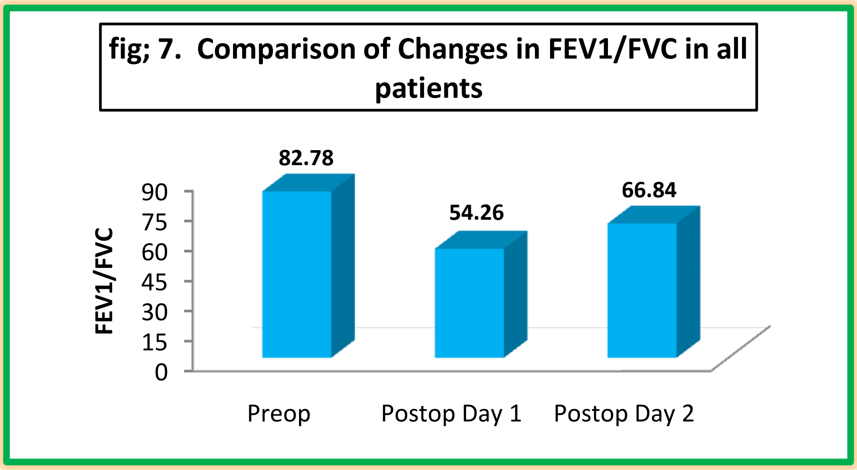
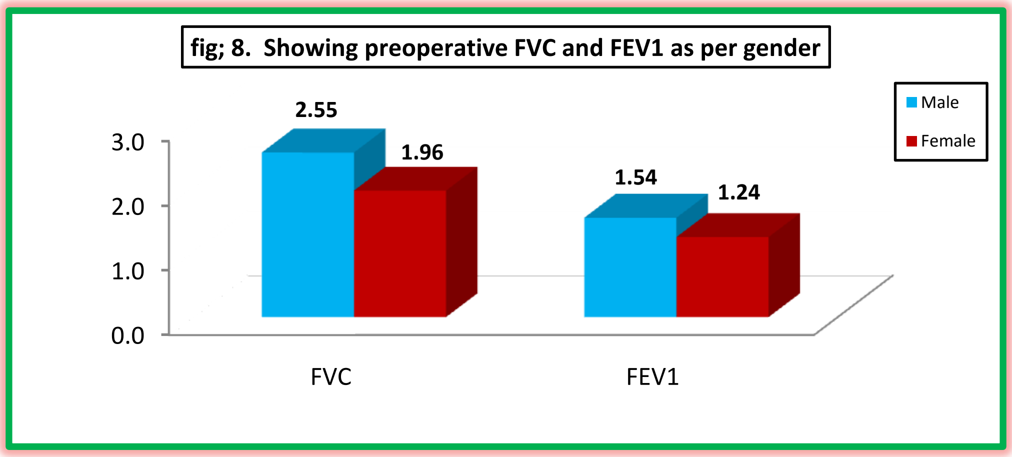


Table 8: Comparison of preoperative FVC, FEV_1 and FEV_1/FVC based on gender

Preoperative	**Male**		**Female**		**P-value**
	Mean	**SD**	**Mean**	**SD**	
FVC	2.55	0.504	1.96	0.362	0.064
FEV_1	1.54	0.403	1.24	0.281	0.173
FEV_1/FVC	80.61	11.85	84.48	11.66	0.143

The mean preoperative FVC in males was 2.25±0.504L & in females 1.96±0.362L (p-value 0.064), FEV_1 in males was 1.54±0.403L & in females 1.24±0.281L (p-value 0.173), FEV_1/FVC in males was 80.61±11.85% & in females 84.48±11.66%(p-value 0.143) asin table 8 and figure 8 and fig 9.



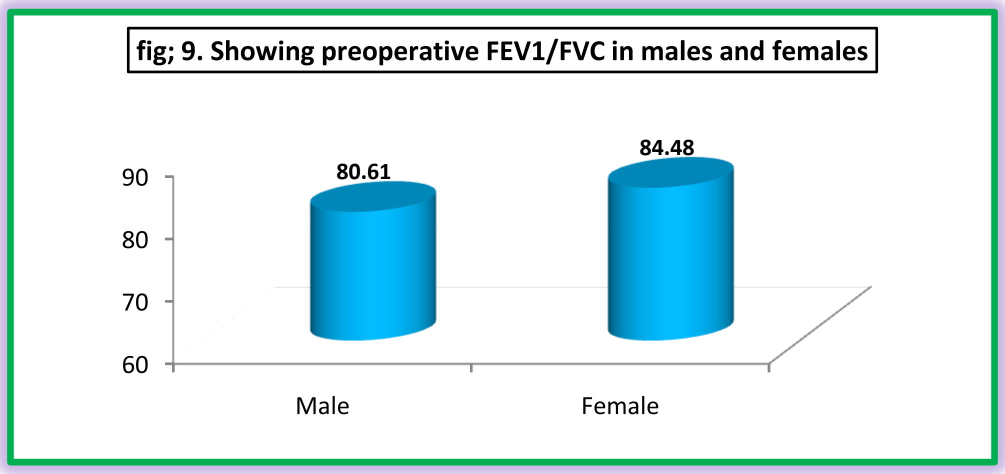


Table 9: Comparison of changes in FVC on the basis of gender

Time Interval	Male		Female		P-value
	Mean±SD	**% Fall**	**Mean±SD**	**% Fall**	
Preop	2.55±0.504	-	1.96±0.362	-	-
Postop Day 1	1.29±0.323	49.4	1.02±0.208	47.9	0.363
Postop Day 2	1.68±0.298	34.8	1.30±0.202	33.7	0.265

The mean postoperative fall in FVC for males was 49.4% and 34.8% on first & second postoperative days, while in case of females it was 47.9% & 33.7% on the two postoperative days respectively. The mean decline in FVC was comparable on both the postoperative days (p-value 0.363 & 0.265 on the two postoperative days respectively) as in table 9 and fig 10.

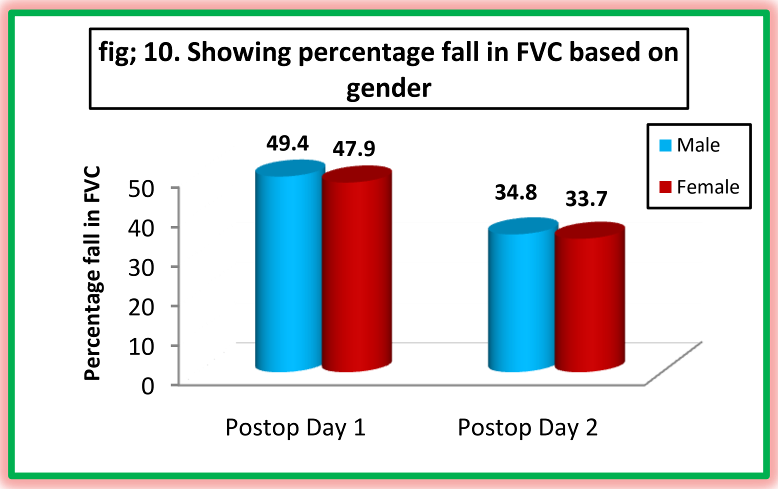


Table 10: Comparison of changes in FEV_1 on the basis of gender

Time Interval	Male		Female		P-value
	Mean±SD	**% Fall**	**Mean±SD**	**% Fall**	
Preop	1.54±0.403		1.24±0.281	-	-
Postop Day 1	0.48±0.091	67.1	0.40±0.112	67.6	0.790
Postop Day 2	0.78±0.159	47.5	0.63±1.30	47.7	0.921

The mean postoperative fall in FEV_1 for males was 67.1% and 47.5%% on first & second postoperative days, while in case of females it was 67.6% & 47.7% on the two postoperative days respectively. The mean postoperative fall in FEV_1 was comparable between males and females (p-value 0.790 & 0.921 on the two postoperative days)as evident in table 10 and fig 11.

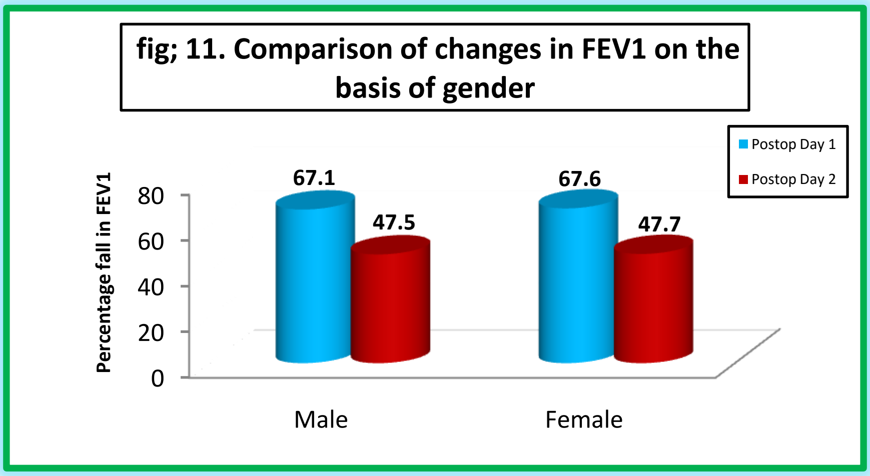


Table 11: Comparison of changes in FEV_1/FVC on the basis of gender

Time Interval	Male		Female		P-value
	Mean±SD	**% Fall**	**Mean±SD**	**% Fall**	
Preop	80.61±11.85		84.48±11.66	-	-
Postop Day 1	54.50±8.68	32.4	54.07±15.99	35.3	0.301
Postop Day 2	64.11±12.59	19.8	65.85±10.12	21.1	0.168

The mean postoperative fall in FEV_1/FVC for males was 32.4% and 19.8% on first & second postoperative days, while in case of females it was 35.3% & 21.1% on the two postoperative days respectively. The mean fall in FEV_1/FVC was comparable between males & females on the two postoperative days (p-value 0.301 & 0.168 on the two postoperative days respectively) as in table 11 and fig 12.

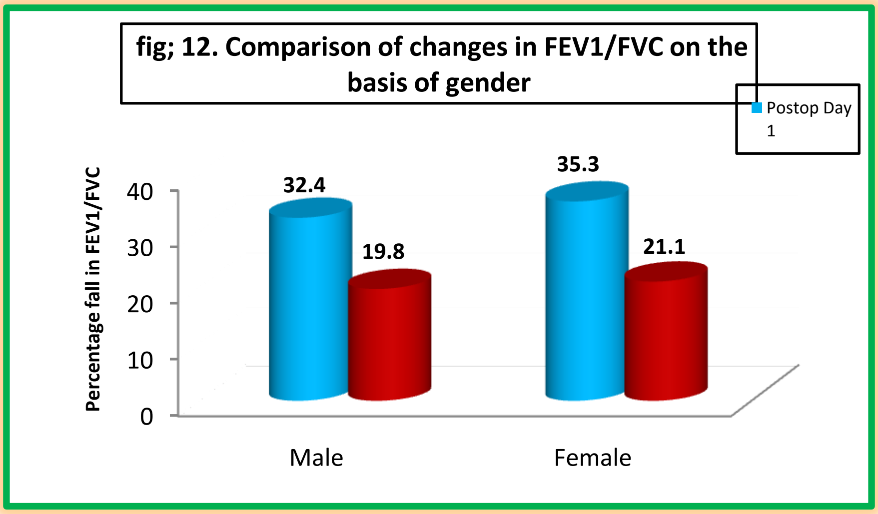
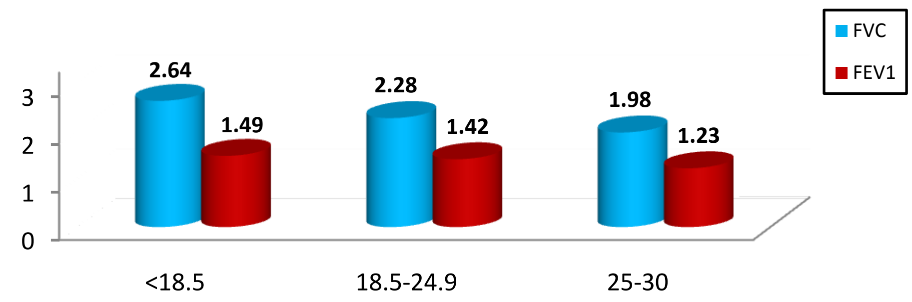


Table 12 : Comparison of preoperative FVC, FEV_1 and FEV_1/FVC based on BMI							
Preoperative	**<18.5**		**18.5-24.9**		**25-30**		**P-value**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
FVC	2.64	0.589	2.28	0.465	1.98	0.927	0.069
FEV_1	1.49	0.362	1.42	0.372	1.23	0.339	0.186
FEV_1/FVC	80.7	11.98	84.3	12.51	80.7	10.29	0.399

The preoperative spirometric parameters were compared on the basis of BMI (Kg/m^2) as in table 12 and fig 13 and 14. The mean preoperative FVC in persons with BMI <18.5 was 2.64±0.589L , in persons with BMI 18.5-24.9 was 2.28±0.465L & in individuals with BMI 25-30 was 1.98±0.927L(p-value 0.069). The mean preoperative FEV_1 in persons with BMI <18.5 was 1.49±0.362L , in persons with BMI 18.5-24.9 was 1.42±0.372L & in individuals with BMI 25-30 was 1.23±0.339L(p-value 0.186).The mean preoperative FEV_1/FVC in persons with BMI <18.5 was 80.7±11.98% , in persons with BMI 18.5-24.9 was 84.3±12.51%& in individuals with BMI 25-30 was 80.7±10.29%(p-value 0.399).

fig; 13. Showing preoperative FVC and FEV1 as per BMI



fig; 14. Showing preoperative FEV1/FVC as per BMI

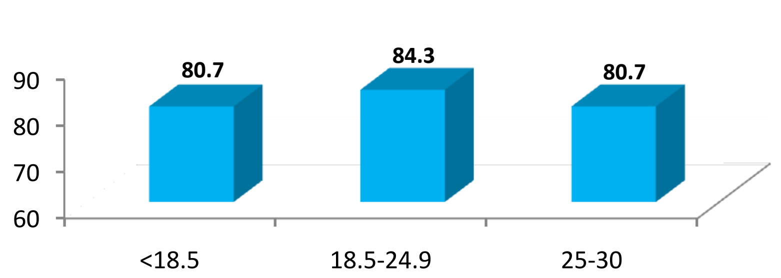


Table 13: Comparison of changes in FVC on the basis of BMI				
Time Interval	**<18.5**	**18.5-24.9**	**25-30**	**P-value**
Postop Day 1	50.5	47.8	50.5	0.646
Postop Day 2	37.0	35.6	33.1	0.367

The mean postoperative fall in FVC for persons with BMI<18.5 was 50.5% & 37.0% on first & second postoperative days respectively, for individuals with BMI 18.5-24.9 was 47.8%& 35.6% on first & second postoperative days respectively, & in case of individuals with BMI 25-30 it was 50.5% & 33.1% on the two postoperative days respectively. The mean decline in FVC was comparable between the groups on both the postoperative days (p-value 0.646 & 0.367 on the two postoperative days respectively)as in table 13 and fig 15.

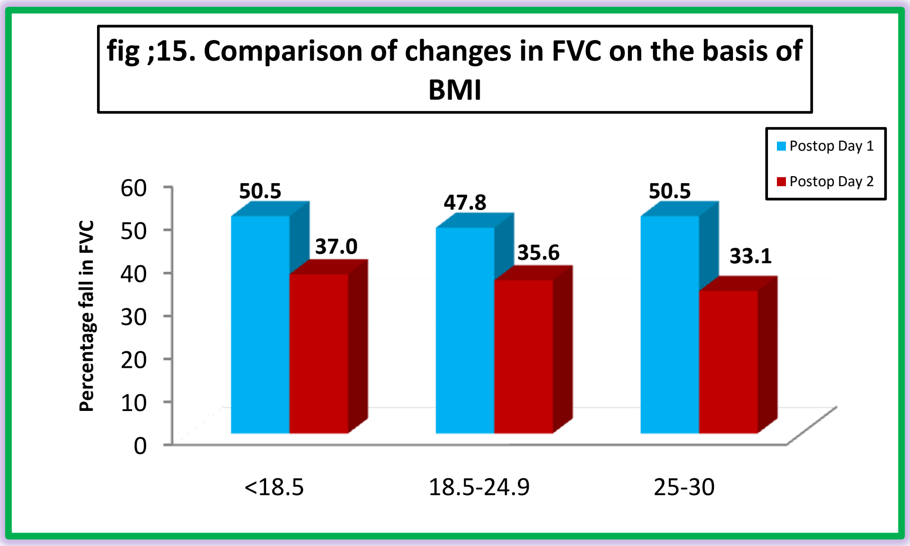


Table 14: Comparison of changes in FEV_1 on the basis of BMI				
Time Interval	**<18.5**	**18.5-24.9**	**25-30**	**P-value**
Postop Day 1	64.7	67.1	69.1	0.367
Postop Day 2	44.5	48.9	52.8	0.540

The mean postoperative fall in FEV_1 for persons with BMI<18.5 was 64.7% & 44.5% on first & second postoperative days respectively, for individuals with BMI 18.5-24.9 was 67.1% & 48.9% on first & second postoperative days respectively, & in case of individuals with BMI 25-30 it was 69.1% & 52.8% on the two postoperative days respectively. The mean decline in FEV_1 was comparable between the groups on both the postoperative days (p-value 0.367 & 0.540 on the two postoperative days respectively) as in table 14 and fig 16.

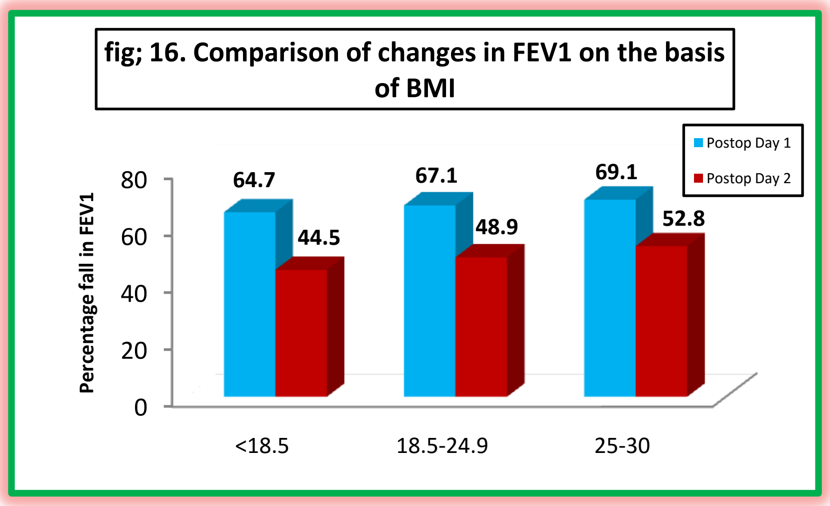


Table 15: Comparison of changes in FEV_1/FVC on the basis of BMI				
Time Interval	**<18.5**	**18.5-24.9**	**25-30**	**P-value**
Postop Day 1	29.3	33.9	34.8	0.635
Postop Day 2	11.2	19.9	22.1	0.240

The mean postoperative fall in FEV_1/FVC for persons with BMI<18.5 was 29.3% & 11.2% on first & second postoperative days respectively, for individuals with BMI 18.5-24.9 was 33.9% & 19.9% on first & second postoperative days respectively, & in case of individuals with BMI 25-30 it was 34.8% & 22.1% on the two postoperative days respectively. The mean decline in FEV_1/FVC was comparable between the groups on both the postoperative days (p-value 0.635 & 0.240 on the two postoperative days respectively) as shown in table 15 and fig 17.

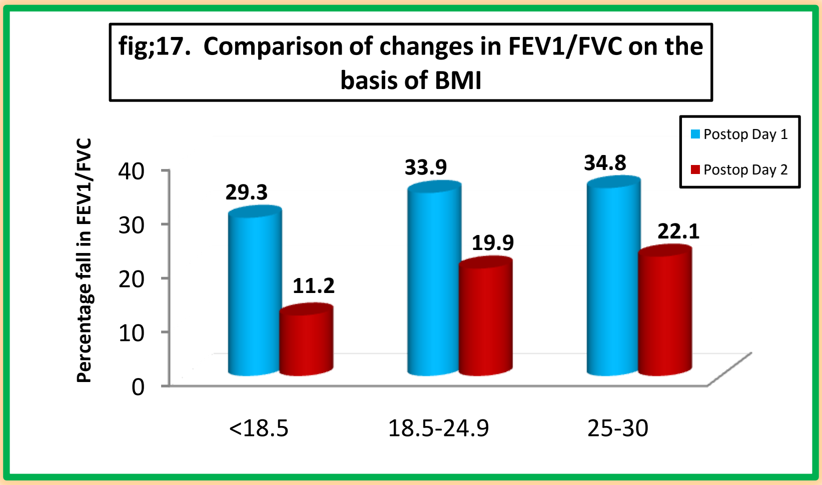


Table 16: Comparison of changes in FVC on the basis of type of surgical incision			
Time Interval	**Cholecystectomy (R. Subcostal)**	**Gastrectomy (Upper midline)**	**P-value**
Postop Day 1	48.3	52.2	0.278
Postop Day 2	34.6	36.9	0.518

The mean postoperative fall in FVC for cholecystectomy group (R. subcostal incision) was 48.3% and 34.6% on first & second postoperative days, while in case of gastrectomy group (Upper midline incision) it was 52.2% & 36.9% on the two postoperative days respectively. The mean decline in FVC was comparable on both the postoperative days (p-value 0.278 & 0.518 on the two postoperative days respectively) as in table 16 and fig 18.

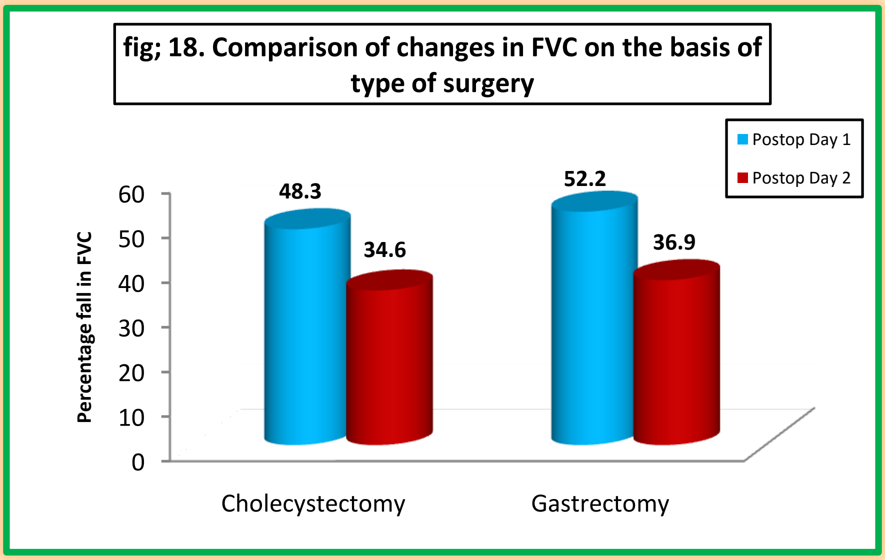


Table 17: Comparison of changes in FEV_1 on the basis of type of surgical incision			
Time Interval	**Cholecystectomy (R.Subcostal)**	**Gastrectomy(upper midline)**	**P-value**
Postop Day 1	64.9	67.9	0.228
Postop Day 2	43	48.6	0.133

The mean postoperative fall in FEV_1 for cholecystectomy group (R. subcostal incision) was 64.9% and 43.0% on first & second postoperative days, while in case of gastrectomy group (Upper midline incision) it was 67.9% & 48.6% on the two postoperative days respectively. The mean decline in FEV_1 was comparable on both the postoperative days (p-value 0.228 & 0.133 on the two postoperative days respectively) as evident in table 17 and fig 19.

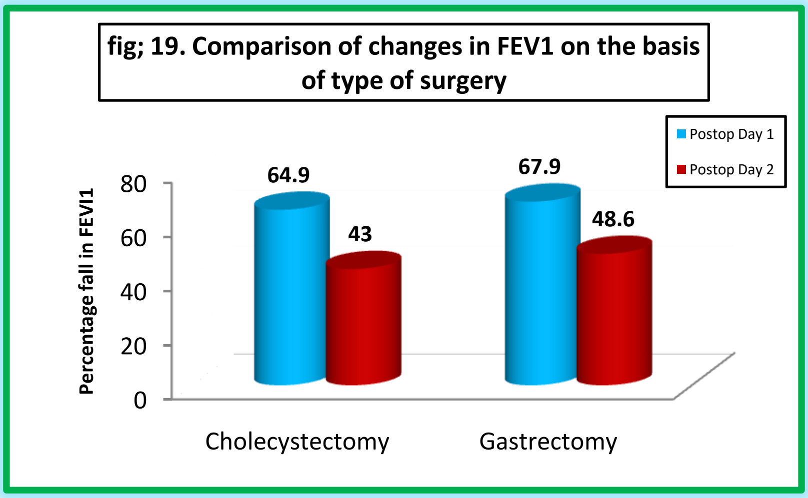
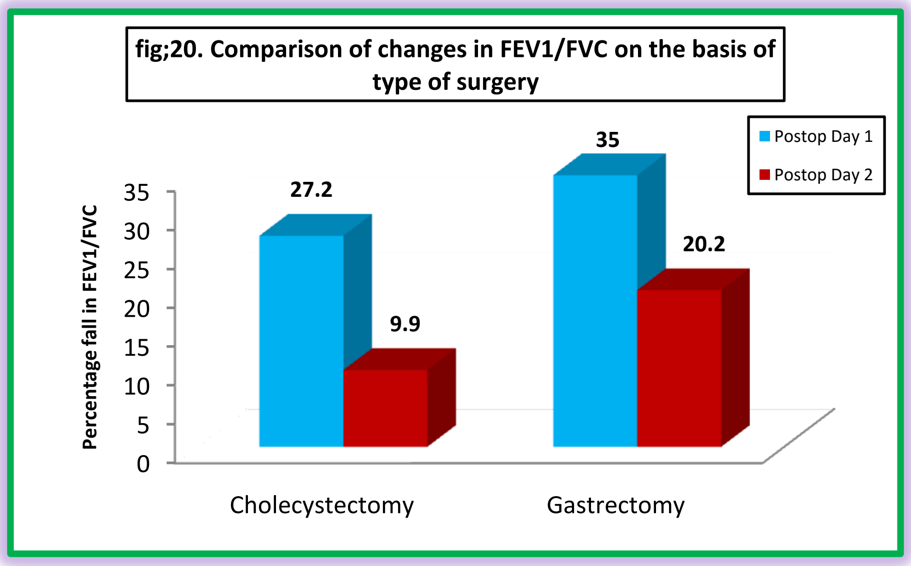


Table 18: Comparison of changes in FEV_1/FVC on the basis of type of surgical incision			
Time Interval	**Cholecystectomy (R.Subcostal)**	**Gastrectomy(upper midline)**	**P-value**
Postop Day 1	27.2	35	0.039*
Postop Day 2	9.9	20.2	0.018*

The mean postoperative fall in FEV_1/FVC for cholecystectomy group (R. subcostal incision) was 27.2% and 9.9% on first & second postoperative days, while in case of gastrectomy group (Upper midline incision) it was 35.0% & 20.2% on the two postoperative days respectively. The mean decline in FEV_1/FVC was more in case of upper midline incision compared to right subcostal incision on both the postoperative days (p-value 0.039 & 0.018 on the two postoperative days respectively) as shown in table 18 and fig 20.



IV. Discussion

Postoperative respiratory insufficiency is a known complication in patients who have undergone major abdominal surgery. Old age and co-existing pulmonary diseases are principal factors in the development of postoperative respiratory insufficiency.[14] The other contributors being pain ,site of surgery, duration and type of anaesthesia, and preoperative hypersecretion of mucus.[4] The role of pulmonary function tests to assess the postoperative pulmonary complications has been validated in many studies**.** In 1962, Stein et al found that 21 of 30 patients (66 percent) with abnormal preoperative pulmonary function developed postoperative complications, the VC and FEV_1 were significantly reduced preoperatively in these patients who developed complications. [15] In 1970, Stein and Cassara found that patients with abnormal preoperative pulmonary function tests had a 42% incidence of postoperative pulmonary complications. [16] Latimer et al have found a 100% incidence of postoperative pulmonary complications in patients with a preoperative ratio of FEV_1/FVC (FEV_1%) of <65% and an FVC of <70 percent predicted. [17]Gracey and colleagues have also demonstrated that patients with abnormal preoperative pulmonary function have a higher incidence of postoperative pulmonary complications. [18]

The primary goal of present study was to determine the impact of upper abdominal surgeries on lung function in elderly patients using spirometric parameters. The present study included a total of 82 patients with age ≥60 years, ASA class II, submitted for upper abdominal surgeries. Similar number of patients were studied by A. J. Karayiannakis, et alin 1996 who had compared postoperative pulmonary function after laproscopic and open cholecystectomy. [19] The mean age of studied patients was 65.1±6.31 years, comparable with the mean age of patients studied by Jin Huh et alin 2013, where the mean age of the patients was 67.0±6.3 years**.** [20] The preoperative FVC and FEV_1 was more for males compared to females, but the difference was statistically non-significant (p-value 0.064 & 0.173). The average pre-operative FEV_1/FVC was comparable between males and females with a statistically non-significant difference (p-value 0.143). In the study conducted by A. Jannie Shimray et alin 2004 regarding Gender difference on spirometric lung functions inpatients of chronic obstructive pulmonary disease , the average baseline FVC and FEV_1 were significantly higher in males as compared to females, however the difference between average FEV_1/FVC was statistically non-significant on the basis of gender. [21] Data analysis for the entire group of study subjects revealed a significant postoperative fall in all the observed spirometric parameters, on the first postoperative day FVC decreased by 47.5%, FEV_1 by 67.4% and percentage fall in FEV_1/FVC was 33.6%. There was a marginal improvement in the spirometric parameters by the second postoperative day, showing a comparatively lesser decline in FVC of 34.3%, FEV_1 47.6% and FEV_1/FVC of 18.3% from preoperative values. However, the fall in all the spirometric parameters remained statistically significant on both the postoperative days. Ronald G. Latimer et alfound similar results in their study "Ventilatory Patterns & Pulmonary Complications after Upper Abdominal Surgery Determined by Preoperative & Postoperative Computerized Spirometry". [22] They found that the mean FVC values were reduced to 35% of the preoperative measurements on the day of operation and there was a persistent 30% decline in the FVC values even on seventh postoperative day. They also noted a 65% reduction in FEV_1 on the day of surgery and it persistently remained on the lower side. However, by the seventh day of surgery the mean FEV_1 value increased to the 70% of the mean preoperative value, as observed in the same study the mean preoperative FEV_1/FVC of 70.5±8.9%, was reduced to 66.1±10.9% on the first postoperative day and 68.1±11.8% on the second postoperative day. There was a far more reduction in FEV_1 percent as observed in the present study possibly due to the fact that the present study incorporated elderly population which was not the case in the study conducted by Ronald G. Latimer et al. In a study by Gilson Cassem Ramos and colleagues, pulmonary function of the patients undergoing laproscopic cholecystectomy was evaluated both preoperatively and postoperatively. [23] Mild restrictive ventilatory defects were observed, with FVC and FEV_1 reduction, when these two variables were compared preoperatively and postoperatively. Therefore, laproscopic cholecystectomy also results in postoperative spirometric changes, an observation that is in agreement with several other scientific journals.[24]

Summary

The present study included a sample size of 82 patients (36M & 46F), with a mean age of 65.1±6.31 years, mean weight 56.3±7.09 kg and mean height 157.8±11.15cms, of ASA class II. Open cholecystectomy (R. Subcostal incision) was performed on 67 patients and gastrectomy (Upper midline incision) was performed in 15 patients. For general population, there was an overall decline in all the observed spirometric parameters in the postoperative period. FVC values showed a 47.5% decline on first postoperative day and 34.3% decline on second postoperative day (p-value <0.001 &0.002 respectively), percentage fall in FEV_1 was 67.4% on first postoperative day and 47.6% on second postoperative day (p-value <0.001). FEV_1/FVC showed a decline of 33.6% on first postoperative day and 18.37% on second postoperative day (p-value <0.001 & 0.0034 respectively). On the basis of gender and BMI the mean decline in spirometric values was comparable between the groups. Patients undergoing gastrectomy (Upper midline incision) had a significantly greater postoperative decline in their lung function parameters compared to patients undergoing cholecystectomy (R. Subcostal incision) .

V. Conclusion

The present study shows that, upper abdominal surgeries are associated with a significant decline in lung function, causing a mixed restrictive and obstructive pattern of pulmonary dysfunction on spirometric parameters in patients undergoing upper abdominal surgeries. Decline in lung function was more significant in patients undergoing gastrectomy compared to cholecystectomy. However, an improvement in all the parameters of pulmonary function was observed from the second postoperative day.

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