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Synergistic Effect of Flow Incentive Spirometer and Diaphragmatic Breathing Exercise for Patients with Upper Abdominal Surgery

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Abstract: ***Background:*** *Postoperative Pulmonary Function Is Affected Be Upper Abdominal Surgery, As Observed By Impairment Of Lung Volumes Such As Total Lung Capacity, Vital Capacity And Tidal Volume. Diaphragmatic Breathing Exercise And Flow Incentive Spirometer Is An Importance Practice In Patients With Upper Abdominal Surgery.* ***Aim****: To Evaluate The Synergistic Effect Of Flow Incentive Spirometer And Diaphragmatic Breathing Exercise For Patients With Upper Abdominal Surgery On Respiratory Measures, Post-Operative Pulmonary Complication And Patients Length Of Hospital Stay:* ***Setting****: The Study Was Conducted In Surgical Department And Post-Operative Care Unit At Aswan University Hospital.* ***Sample:*** *A Convenience Sample Of 120 Adult Patients Undergoing Upper Abdominal Surgery Were Divided On Random Basis Equally Into Three Groups (40 For Each) . Diaphragmatic Breathing,Flow Incentive Spirometry And Diaphragmatic Breathing Exercise And Flow Incentive Spirometry Group. Data Were Collected Within One Year From January 2016 To December 2017.* ***Tools:*** *Demographic And Medical Data Sheet, Mobility Indicators And Respiratory Measures, Post-Operative Pulmonary Complication Sheet And Patients Length Of Hospital Stay Sheet.* ***Results:*** *There Were Statistically Significant Differences In Respiratory Measures Oxygen Saturation, Forced Vital Capacity And Peak Expiratory Flow Rate After Performing Both Diaphragmatic Breathing Exercise And Flow Incentive Spirometer Together. Also, There Was Increased Percentage Of Patients Who Spent Less Than Three Days In Hospital And Patients Discharged To Home In The Incentive Spirometry & Diaphragmatic Breathing Exercise Group When Compared With The Diaphragmatic Breathing Exercise, And Flow Incentive Spirometer Group .A Statistical Significant Difference Between The Three Groups As Regard To Relation Between Length Of Hospital Stay And Patient Discharge.* ***Conclusion& Recommendation:*** *The Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Together Can Be Recommended For All Patients Undergoing Upper Abdominal Surgery To Improve Postoperative Pulmonary Functions And Prevent Respiratory Complications As Well As Reduce Length Of Hospital Stay.*

Key Words: *Synergistic, Flow Incentive Spirometer, Diaphragmatic* Breathing , Exercise, Upper Abdominal Surgery

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I. Introduction

Respiratory Exercise And Flow Breathing Spirometer Is An Exercise Of Importance For Patients With Upper Abdominal Surgery. Abdominal Surgery That Has Been Previously Performed Through A Large Incision Is Now More Common A Laparoscopic Procedure. Endoscopic Surgeries Include Structures Such As Gallbladder, Colon, Intestine, Stomach And Liver **(Denehy, 2007).**

(Yang, Et Al., 2010) Reported That Upper Abdominal Surgery Changes Postoperative Pulmonary Function, As Noted By Weak Lung Sizes Such As Total Lung Capacity, Tidal Volume And Bioenergy. Also It Reduces The Efficiency Of Cough Efforts For More Than One Week, As Well As Pneumonia That Occur In (6-70% Of Patients).

Postoperative Pulmonary Complications Have Been Found To Be Lower In Patients With Upper Abdominal Surgery Who Receive Physiotherapy And Respirator Compared To Those Who Do Not Take It **(Chomillas Et Al., 1998 And Ambrosino 2012).** This Effect Is The Result Of The Application Of Various Forms Of Lung Expansion And Secretion Removed Techniques. However, Lung Expansion And Cough Exercises, Changing The Patient's Position And Assisting In Early Mobilization Are Responsible For The Reduction In Postoperative Pulmonary Complications **(Ambrosino And Gabrielle 2010).**

The Beneficial Effects Of Diaphragmatic Breathing Include; Inflation In The Alveoli, Reversing Postoperative Hypoxia, Improving Ventilation And Oxygenation, Reducing Breathing Action, And Increasing Flight Degree Of The Diaphragm **(Grams Et Al., 2012).**

The Incentive Spirometry (IS) Technique Was Used To Encourage The Patient To Take Maximum And Long Inspiration, And Slow Deep Breathing Using A Device To Measure Flow Or Sound. Exposure To Maximal Inspiration During Three Seconds May Increase Pulmonary Transit Pressure Thereby Improving Inspiratory Volumes And Inspiratory Muscle Performance **(Do Nascimento Et Al., 2014).**

The Series Role Of A Of Physiotherapist And Nurse Staff In The Management Of Patients After Upper Abdominal Surgery. These Interventions May Include Lung Exercises, Techniques, Limb Exercises, Progressive Mobilization Programs, And Other Physiotherapy Techniques For The Chest **(Savci Et Al., 2011).**

The Aim Of The Study:

To Evaluate The Synergistic Effect Of Flow Incentive Spirometer And Diaphragmatic Breathing Exercise For Patients With Upper Abdominal Surgery On Respiratory Measures, Post-Operative Pulmonary Complication And Patient's Length Of Hospital Stay.

Significance Of The Study

Upper Abdominal Surgeries May Alter Lung Function Leading To Pulmonary Complications. Many Researchers Studied The Effect Of Chest Physiotherapy On The Outcome Of Those Patients. Therefore, This Study Aims To Study The Synergistic Effect Of The Inhaled Flow Gauge And The Exercise Of Ventricular Breathing On The Basis Of A Standardized Early Mobilization Program (Day) To Reduce Pulmonary Complications After Surgery And Improve Pulmonary Function After Upper Abdominal Surgery.

II. Patients And Method

Study Hypothesis:

H_1. Patients Who Applying Both Diaphragmatic Breathing Exercise And Flow Incentive Spirometer Together Immediately Post Upper Abdominal Surgery Well Be Improve In Their Pulmonary Function Than Those Who Applying Diaphragmatic Breathing Exercise Or Flow Incentive Spirometer Only.

H_2. Hospital Stay Will Be Reduced Among Patients Who Will Apply Both Diaphragmatic Breathing Exercise And Flow Incentive Spirometer Together Immediately Post Upper Abdominal Surgery Than Those Who Will Apply Diaphragmatic Breathing Exercise Or Flow Incentive Spirometer Only.

Study Design: A Quasi-Experimental Research Design Was Utilized In This Study.

Study Setting:

This Study Was Conducted In The Surgical Department And Post-Operative Care Unit At Aswan University Hospital.

Study Sample: A Total Number Of 120 Adult Patients Was Divided On Random Basis Equally Into Three Groups (40 For Each), Of Both Sexes, In Day With Upper Abdominal Surgery, Age From 18 To Less Than 60 Years Old, Free From Other Comorbidity Disease.

Tool Of The Study:

The Study Tool Was Used To Collect The Necessary Data And Included The Following Parts:

Part I: Demographic And Medical Data: Was Developed By The Researcher After Passing Through An Extensive And Relevant Review Of Literature. It Contain Socio-Demographic Variables: Name, Age, Sex, & Marital Status Also The Clinical Characteristics Including; Height, Weight (Kg), BMI & Oxygen Saturation , As Well As The Medical Data Such As Smoking, Pulmonary & Cardiac Disease

Part 11: Respiratory Measures Assessment: It Was Developed By **Johnson And Theurer (2014)** And Consisted Of 5 Items Under Main Four Headings That Covered All Post-Operative Pulmonary Function Test And Included: Heart Rate, Respiratory Rate, Spo2 (%), Co2 Result, Forced Vital Capacity (FVC) , And Peak Expiratory Flow Rate (PEFR) . The Total Score Of All Measures Is 130 Grades, The Score Started From Zero To Five Grades. Less Than 68.4 (60%) Considered Having Poor Pulmonary Function Test And Respiratory Measures. Those Who Obtain (60%) Were Considered As Having Satisfactory Result And Above Were Considered Having Good Result Of Pulmonary Functions.

Part III: Post-Operative Pulmonary Complications Sheet: Was Developed By **Canet., (2010).** It Consisted Of 10 Items Covering All Pulmonary Complications: Fever, Atelectasis, Acute Respiratory Distress Syndrome, And Pneumonia Each Item Has Been Noted, Categorized, And Scored At Yes = 1 Or No = 0 On All Items.

Part IV: Patients Length Of Hospital Stays Assessment: Developed By **Brooke And Ames (2011).** To Assess Patient's Duration Of Hospital Stay As Length Of Hospital Stay 1 - 3 Days To Detect If The Patient Stay In

Hospital More 3 Days, Discharged With Complication, Transferred To Hospital Department, Discharged To Home, Or Died. It Consisted Of 6 Items. Total Score Was (12) Grade, Each Item Took From 3 Grade To Zero.
The **Content Validity** Of This Tool Was Checked By Expert Professors In The Fields Of Medicine And Nursing And Corrections Were Carried Out Accordingly. The **Reliability** Was 0.8, By The Kuder–Richardson-19 (KR-19) Formula. KR-19 Used With Dichotomous Items.

Diaphragmatic Breathing Exercise And Mobility Instructions:

The General Objective Of The Instruction Was To Help Patients Understand The Practices To Be Performed As; Chest Exercises And Mobility Post-Operatively. The Patient Was Able To Cooperate And Help The Researcher. The Educational Instruction Was Developed By The Researchers Based On The Knowledge Needs In A Form Of Printed Arabic Booklet. It Was Also Supplemented By Pictures And Information Like; Steps Of Chest Physiotherapy How To Move And Transfer Based On Review Of Relevant Literature**.** Then The Instruction Was Reviewed By A Panel Of Experts Before Its Application To Patients.

III. Methods

Data Collection:

Official Approval Letter Was Obtained From The Head Of The Surgical Department And Post-Operative Care Unit At Aswan University Hospital To Conduct The Research. Oral Consent Was Taken From Patients Who Participated In The Study After Full Explanation Of The Study.
This Study Was Carried Out Through A Period Of One Year From January 2016 To January 2017. The Studied Patients Who Meet The Criteria For Inclusion Were Identified Daily From Admission Records. Patients Were Divided Into Three Groups According To The Type Of Breathing Used: Diaphragmatic Breathing Exercise Group, Flow- Incentive Spirometry Group, And Flow- Incentive Spirometry & Diaphragmatic Breathing Exercise Group. The Study Patients Interviewed Individually One Day Prior To The Surgery; Preoperative Information Was Offered, Data Collection From Nurses Sheet Also Was Done.

Procedures

Started By Assessing The Patient's Mobility After Assessment Of The Patients Vital Signs As: Stable Blood Pressure And Heart Rate And Dyspnea At Rest, If Were In Normal Range, Then Started To Move The Patients, By Sitting The Patient On The Bed (Semi Fowler Position) .

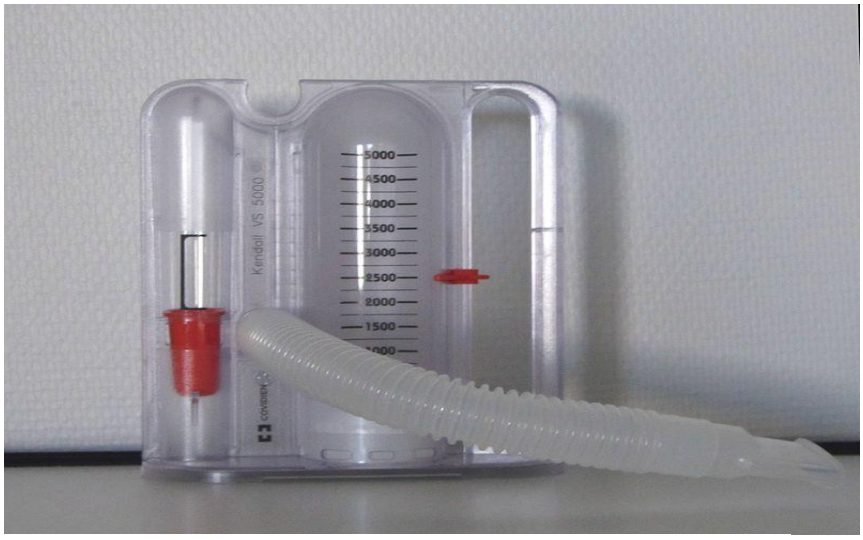
Diaphragmatic Breathing Exercise Performance Group:

Firstly The Researcher Explained The Procedure To The Patient And Give Him An Illustrated Book Let To Help Him To Understand What To Do. The Patient Assumed A Comfortable Semi-Fowler's Position (Back And Head Are Fully Supported And Abdominal Wall Is Relaxed). The Researcher Placed Her Hands Just Below The Anterior Costal Margin, On The Rectus Abdominals, Then, Instructed The Patient To Take Slow Deep Inspiration To Expand The Diaphragmatic Region, Followed By Slow Expiration, After That, Take Deep Inspiration Followed By A Three-Second Pause At Maximal Inspiratory, Ended By Slow Expiration. Then, Inhale Slowly And Deeply Through The Nose, From The Remaining Functional Capacity To The Total Lung Capacity With Three Seconds Of Waiting Breath. After That, The Patient Instructed To Relax The Shoulders, Keep The Chest Top Quiet In Order To Be Slightly Raised Abdomen. In The Repetition Between Exercise And Ventral Breathing, The Patient Was Told To Breathe Normally. At The End, The Nurse Was Asked To Perform Respiratory Measures Arterial Blood Gases (ABG) Spo2, Co2, And Help The Physician Of To Perform Pulmonary Function Test Was Assessed By Portable Spirometry. The Patient Is Required To Endure Upright And Inhale Slowly, Thus Lifting The Ball, Followed By Volume-Gauge Breathing Stimulus In Order To Lift The Piston Or Plate In The Chamber To The Specified Target. After 2-3 Tidal Breaths, The Patients Were Asked To Inhale Deeply To The Total Lung Capacity And Then Exhaled Directly (Without Any Interruption) At A Maximum Rate Until The Air Is Expelled As Far As Possible From The Lungs. Participants Were Encouraged To Continue Exhaling Until The End Of The Test Criteria Of At Least 6 Seconds, Changing The Size Of Less Than 40 Ml And More Than 2 Seconds Is Satisfactory Then, The Forced Vital Capacity (FVC) L, The Peak Flow Rate Of Exhalation (PEFR) L / A Second Were Recorded.

Flow Spirometer Performance Group:

The Patient Is Sited In A Comfortable Position (Semi-Recumbent Position Of 45 Degrees), With A Pillow Under The Knees, And Then Asked To Perform This Technique With The Same Order To Ensure That She / He Understands The Process. The Patient Was Instructed To Inhale With A Slow Continuous And Deep Breathing, And Hold For A Period Of Not Less Than 5 Seconds And Exhale Passively. And Is Instructed To Hold The Spirometry Upright To Perform Slowly Inhalation, Thus Lifting The Ball, Followed By Volume Measuring Breath Incentive For The Piston Or Plate In The Chamber To The Set Target.. At The End Of The Evaluation Of

Respiratory Measures For Patients With Lung Function , And Then Compare The Results With The Previous Results.



Incentive Spirometer Adopted From Https://En.Wikipedia.Org/Wiki/Incentive_Spirometer

Diaphragmatic Breathing Exercise And Flow Spirometry Performance Group:

Patient's Perform Diaphragmatic Breathing Exercise And Flow Spirometry As Stated Earlier, The Patient Take Few Minutes Between The Two Practices. At The End, Patient's Respiratory Measures And Pulmonary Function Was Assessed As The Steps Above, Then Compare Them With The Previous Results And Record The Results.

Ethical Consideration

Oral Consent Was Taken From Each Patient After Explaining The Aim And Benefits Of The Research. The Researchers Emphasized That Participation In The Study Was Completely Voluntary And Each Patient Has The Right To Withdraw From The Study At Any Time Without Giving Any Reason. As Well As, Anonymity And Confidentiality Were Assured Through Coding And Tabulating The Data.

Statistical Design

All Data Were Analyzed And Tabulated. SPSS Software Version 19 Was Used For Statistical Analysis. Data Were Expressed As Frequency And Percent. Numerical Data Were Expressed As Mean And Standard Deviation (SD). T-Test Was Used To Compare Each Of The 3 Studied Groups Numerical Data. Chi Square Test Was Used To Compare Studied Groups Of Numerical Data. P-Value Was Considered To Be Significant If Less Than 0.05, High Significant If Less Than 0.001, Or Insignificant If More Than 0.005.

IV. Results:

Table (1) Show The Socio-Demographic Data And Clinical Characteristics For The Studied Groups And Reveal That, There Were No Statistically Significant Differences Between Groups, The Mean Age Was (**30.2000 ± 7.40132**). About Two Thirds Of The Three Groups (77.5%) Were Male. Non- Statistically Significant Difference Was Found Between The Studied Groups Regarding Height, Weight (Kg), Oxygen Saturation Before Surgery, & Duration Of Surgery.

Table (2) The Medical Characteristics Among The Studied Groups Revel That, The Majority Of The Studied Groups In Flow Incentive Spirometer Group (80%) Were Smokers. Approximately 10.00% Of The Studied Sample Had Pulmonary Problems. Also 27.5% Of The Studied Sample Had Cardiac Problems.

Figure (1) Illustrated That**,** (54.16%) Of The Studied Groups Had Performed Laparoscopic Surgery, While (45.84%) Of Them Had Undergone Hernioplasty.

Table (3) Depicts That; More Than Half Of The Studied Sample Had Improved Cognitive Function (Alert And Orientated) Post-Surgery In The Diaphragmatic Breathing Exercise And Flow Incentive Spirometry Groups With A Statistically Significant Differences Between The Studied Groups Regarding Ability To Walk In The 1st Day For 30 M Independently.

Table (4): Showed That, There Was A Statistically Significant Difference Between Studied Groups In Respiratory Measures, Spo2 (%) Forced Vital Capacity (FVC) And Peak Expiratory Flow Rate (PEFR).

Table (5) Illustrate That, There Was Highly Statistical Significantly Difference Between The Studied Groups, Regarding Occurrence Of Post-Operative Complications. (P Values=.000**).

Figure (2): Reveal An Increased Percentage Of Patients Who Spent Less Than Three Days In Hospital And Patients Discharged To Home In The Flow Spirometry & Diaphragmatic Breathing Exercise Group With Statistical Significant Difference Between The Three Groups (P Values=.000**).

Table (6): Illustrate That, There Was A Significant Correlation Between BMI And The Diaphragmatic Breathing Group, Flow Incentive Spirometer And (Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Group P= (P<0.05, P<0.05* & P<0.001) Respectively. Also The Study Findings Revealed A Significant Correlation Between Surgery Duration And Flow Incentive
Spirometry & Diaphragmatic Breathing Exercise Group .

Table (1): Distribution Of The Study Sample As Regard Socio Demographic And Clinical Characteristic For Patients With Upper Abdominal Surgery In The Studied Groups (No=40 For Each Group).

Characteristic	Study group No=120						p- value
	Diaphragmatic breathing exercise (N = 40)		Flow incentive spirometry (N=40)		Diaphragmatic breathing exercise and flow incentive spirometry (N = 40)		
Age (years):	No.	%	No.	%	No.	%	
< 20	1	2.5	4	10.0	1	2.5	
20 - <30	16	40.0	10	25.0	16	40.0	
30 - <40	19	47.5	16	40.0	4	10.0	
40 - <55	4	10.0	10	25.0	19	47.5	
Mean ±SD	**30.2000 ± 7.40132**		**30.3000 ± 6.50144**		**30.2000 ±4.60143**		0.442
Sex							
▪ Male	27	67.5	25	62.5	31	77.5	
▪ Female	13	32.5	15	37.5	9	22.5	
Height Mean ±SD	**1.7100E2±9.23205**		**1.8200E1±6.25203**		**1.7600E2±8.25602**		562
Weight (kg) Mean ±SD	**85.3250±17.23241**		**85.4620±12.35621**		**85.4130±16.26442**		511
BMI Mean ±SD	**33.1240±6.21191**		**25.23427±5.17522**		**22.53929±13.41633**		288
O2	**2.68932 ± 0.5832**		**2.36781 ± .41642**		**2.77924 ±2.62851**		352
Surgery duration (in minutes): Mean ±SD	**2.7453 ± 0.59126**		**2.25951 ± .33926**		**2.8282 ± .95481**		263

Table (2): Frequency And Percentage Distribution Of The Study Groups As Regards Their Medical Data (No=40 For Each Group).

Items	iaphragmatic Breathing Exercise (N = 40)				Flow Incentive Spirometer (N=40)				iaphragmatic Breathing Exercise And Flow Incentive Spirometry (N = 40)			
	Present		Not Present		Present		Not Present		Present		Not Present	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Smoking	13	32.5	10	25.0	32	80.00	9	22.5	29	72.5	11	27.5
Life-Long Non-Smoke	27	67.5	13	32.5	25	62.5	5	12.5	28	70.00	12	30.00
Pulmonary Disease	4	10.0	36	90.00	3	7.5	37	92.5	1	2.5	39	97.5
Cardiac Disease	11	27.5	29	72.5	11	27.5	29	72.5	0	0.00	40	100.00

Figure (1): Distribution Of The Studied Groups Regarding To The Type Of Operation (No=40 Each Group).

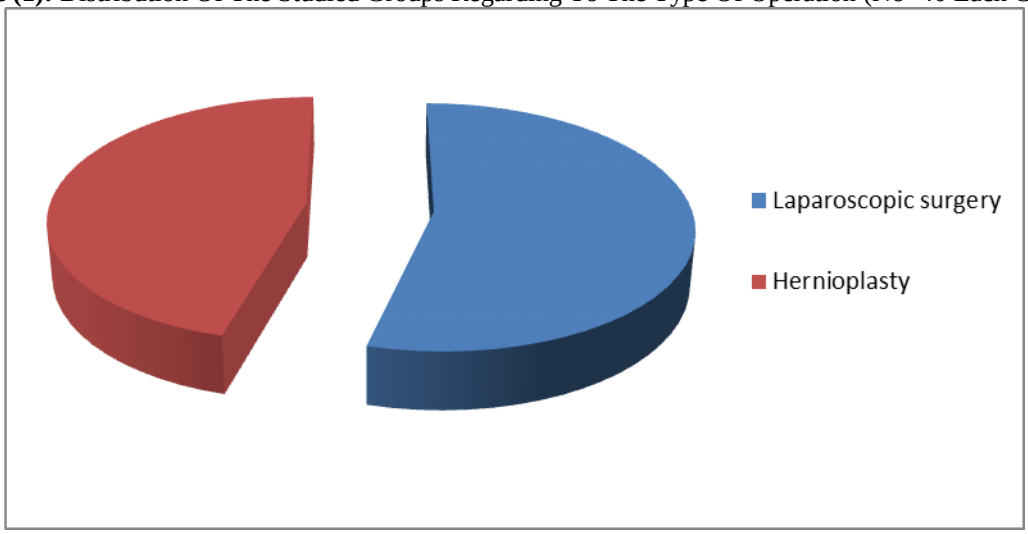


Table (3): Frequency And Percentage Distribution Of The Studied Groups Regarding Post-Operative Mobility Indicators (No=40 In Each Group).

Items	iaphragmatic Breathing Exercise (N = 40)		low Incentive Spirometer (N=40)		iaphragmatic Breathing xercise And Flow Incentive Spirometry (N = 40)		P-Valu
	No.	%	No.	%	No.	%	
Mobility Indicators							
1st Day Sat Out Of Bed	21	52.5	19	47.5	29	72.5	<0.001
1st Postoperative Walk	11	27.5	7	17.5	25	62.5	<0.001
1st Day Able To Walk 3 M Independently	4	10.00	3	7.5	8	20.00	<0.001**

. **Table (4):** Comparison Between The Studied Groups As Regard Post-Operative Respiratory Measures (No=40 For Each Group).

Items	iaphragmatic Breathing Exercise (N = 40)	Flow Incentive Spirometer (N=40)	iaphragmatic Breathing xercise And Flow Incentive Spirometry (N = 40)	P-Value
Respiratory Measures:	Mean ±SD	Mean ±SD	Mean ±SD	
Respiratory Rate (Pm)	19.4000±2.62603	19.5000±2.65312	18.1000±1.42336	00.00
Spo2 (%)	20.3000±1.63613	20.4000±1.43512	20.7000±1.94722	<0.001**
Co2 Result	87.5500±3.25773	89.2300±4.21552	70.7800±1.25223	<0.001**
Forced Vital Capacity(FV L	12.4915± 4.31022	12.4915± 4.31022	12.4915± 4.31022	<0.001**
Peak Expiratory Flow Ra (PEFR)L/S	1.1590E2±24.06700	1.1440E2±24.06700	1.2670E2±27.08800	<0.001**

% Change. Not Significant At P>0.05.* Significant At P<0.05 Level. **Highly Significant At P<0.001 Level

Table (5): Comparison Between The Studied Groups Regarding To Occurrence Of Post-Operative Pulmonary Complications. (No=40 For Each Group).

Items	iaphragmatic Breathing Exercise (N = 40)	ow Incentive Spirometer (N=40)	iaphragmatic Breathing Exercise And Flow Incentive Spirometry (N = 40)	P-Value
	Mean ±SD	Mean ±SD	Mean ±SD	
Fever	2.2000±2.52603	1.4000±1.52403	1.6000±1.4250	<0.001**
Atelectasis:	5.2555±1.0052	5.2567±1.0002	3.12403±1.5102	<0.05
Acute Respirato Distress Syndrome:	6.4000±2.5260	6.4500±103252	2.3300±1.2205	<0.001**
Pneumonia:	1.3500±1.43002	1.3400±1.4402	1.2200±104403	<0.05*

Not Significant At P>0.05.* Significant At P<0.05 Level. ** Highly Significant At P<0.001 Level

Figure (2): Percentage Distribution Of The Studied Groups In Relation To Length Of Hospital Stay And Patient Discharged (No=40 In Each Group).

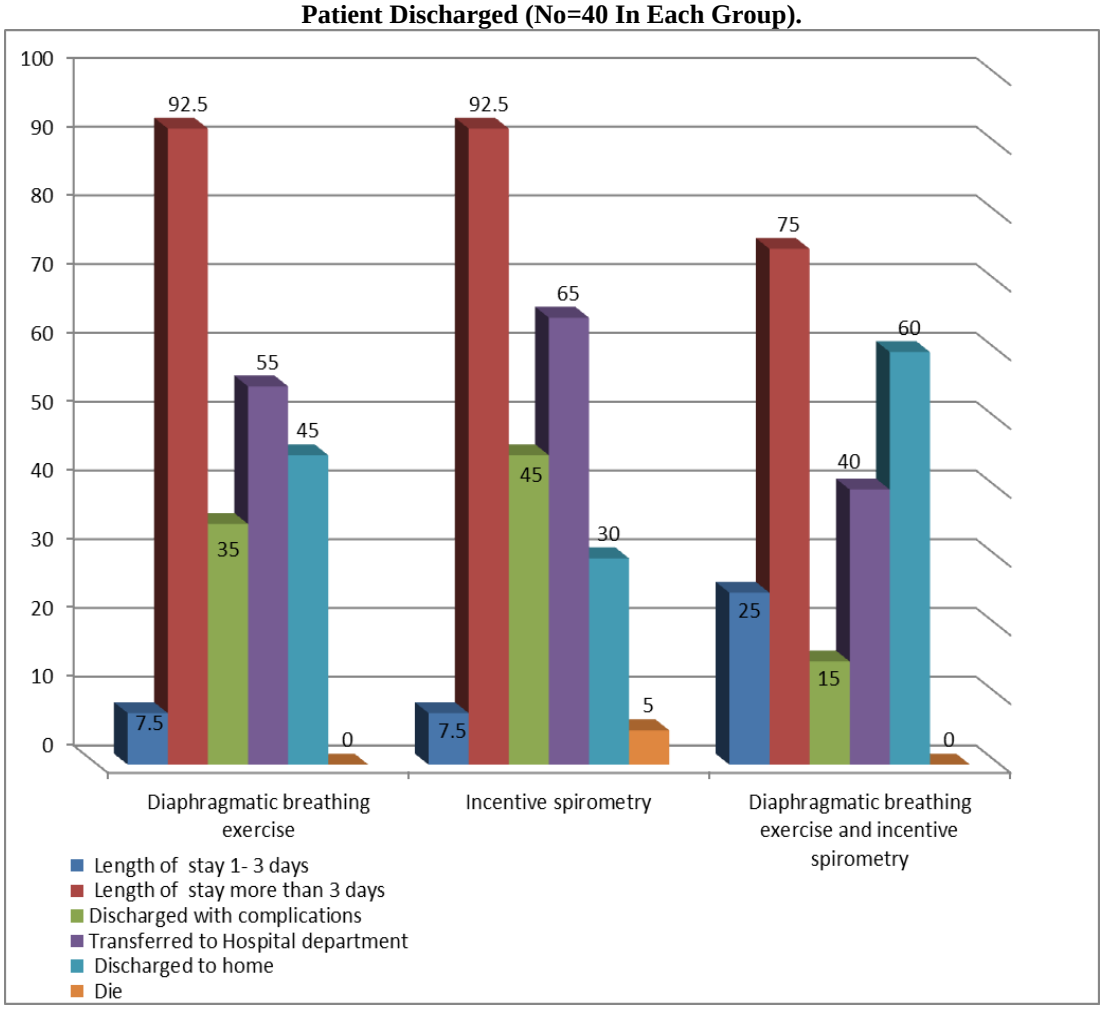


Table (6): Relation Between BMI & Surgery Duration In The Three Studied Groups (No=40 For Each Group).

Items	**BMI Mean ±SD**	**Surgery Duration Mean ±SD**
iaphragmatic Breathing Exercise	33.1240±6.21191 P<0.05*	2.7453 ± 0.59126 P >0.39
Flow Incentive Spirometer	25.23427±5.17522 P<0.05*	2.25951 ± .33926
iaphragmatic Breathing Exercise And Flow Incentive Spirometer	22.53929±13.41633 P<0.001 **	2.8282 ± .95481 P<0.001**

* Correlation Is Significant At The 0.05 Level (2-Tailed).
** Correlation Is Significant At The 0.01 Level (2-Tailed).

V. Discussion

Pulmonary Problems After Upper Abdominal Surgery Is Widely Spread And Is Responsible For Increasing Rates Of Illness Or Mortality, As Well As Hospital Stay And Health-Related Costs And Care **(Possa, 2014).** The Recognized Risk Rates Of Postoperative Pulmonary Complications Ranged From 17% To 88% In Upper Abdominal Surgery **(Guimaraes,Et Al., 2009).**

Flow Incentive Spirometer (FIS) And Volume Incentive Spirometer (VIS) Have Been Observed To Be Successful In Enhancing Pulmonary Functions Post Upper Abdominal Surgery **(Gaur, & Parekh, 2016).** Diaphragmatic Breathing Exercise Diminish Action Of Accessory Muscles, Lessen The Work Of Breathing And Guarantee Full Expansion Of The Lungs In This Manner Opening Up Alveoli **(Alaparthi Et Al., 2013).**

The Aim Of This Was Study To Evaluate The Synergistic Effect Of Flow Incentive Spirometer And Diaphragmatic Breathing Exercise For Patients With Upper Abdominal Surgery. The Findings Of The Present Study Revealed That, There Were No Statistical Significant Differences In The Basic Data (Patient's Demographic & Clinical Characteristics) Between The Three Groups.

Regarding Age, The Age Highest Percentage Was (47.5%) For Age Group (30 - < 40). This Result Is Contradicting With **(Ehab, 2017)** Who Stated That The Majority Of Patients With Upper Abdominal Surgery Were In The Age Ranged Between (32-50 Years)**.** Concerning Gender Data Presented That More Than Half Of The Three Groups (67.5, 62. 5 & 77.5) Respectively Were Male This Findings Agree With **(Pascoa, 2016)** Who Stated That, More Than Half Of Patients Who Had Undergone Upper Abdominal Surgery **(**57.8%) Were Male.

In Relation To The Medical Characteristics For Patients With Upper Abdominal Surgery The Majority Of The Studied Groups In Flow Incentive Spirometer Group (80%) Were Smoking And More Than One Fourth Of Both Flow Incentive Spirometer And Diaphragmatic Breathing Exercise Group Had Hypertension (27.5%) With No Significant Difference Between The Three Groups Regarding Smoking And Cardiac Disease. This Result Was Supported By **(Kumar, 2016)** Who Mentioned That The Highest Percentage Of Patients Of The Flow Incentive Spirometer Group With Upper Abdominal Surgery Were Smokersr And About One Third Of Them Had Cardiac Problems .Also, There Were No Statistical Significant Differences Related To Medical Characteristic For Patients With Upper Abdominal Surgery (Smoking, Lifelong Smoking, Pulmonary & Cardiac Disease) Between The Three Groups**.**

The Findings Of The Current Study Revealed That The Highest Percentage Of Patients Had Performed Laparoscopic Surgery, This Result Was In Agreement With (**José, Et Al., 2014)** Who Concluded That, Laparoscopic Surgery Is A Very Common And Widely Established Technique.

Postoperative Cognitive Dysfunction Has Been Recognized As A Large Problem Resulting In Reduction In The Quality Of Life Through The Impairment Of Daily Activity, Increased Morbidity And Mortality Post Specific Abdominal Surgery. So It Is Important To Look At The Postoperative Cognitive Dysfunction As Well As Cardiac And Pulmonary Complications **(Gennaro, Et Al., 2017)**.

As Regards Mobility Indicators Among The Studied Groups , The Study Findings Revealed That, The Highest Percentage Of Patients Who Were 1st Day Able To Walk In The Day For 30 M Independently In The Diaphragmatic Breathing Exercise And Flow Incentive Spirometry Group With A Statistical Significant Difference Between The Three Groups . In This Respect, **(Perme, & Chandrashekar, 2009)**, Reported That There Is An Increasingly Compelling Body Of Evidence That Physical Activity 1–2 Times Per Day For Up To 15–30 Min Is Both Safe And Efficacious For Upper Abdominal Surgery And Critically Ill Patients.

According To **(Possa, Et Al., 2014**), Early Movement Appeared To Expand Lung Volume, Prevent Atelectasis And Enhance Gas Exchange And This By All Is Considered More Effective Than Deep Breathing Activities In The Avoidance Of Postoperative Respiratory Complications.

Concerning The Comparison Between The Studied Groups As Regards Post-Operative Respiratory Measures, The Present Study Reported An Improved Post-Operative Respiratory Measures Of The Diaphragmatic Breathing Exercise & Flow Incentive Spirometry Group Compared With The Flow Incentive Spirometer And Diaphragmatic Breathing Exercise Group With A Statistically Significant Difference Between The Studied Groups Regarding Respiratory Measures Of, Spo2 (%) Forced Vital Capacity (FVC) And Peak Expiratory Flow Rate (PEFR).

These Results Comes In Agreement With **(Kumar, 2016)** Who Concluded That, Flow Incentive Spirometry Can Be Securely Prescribed To Patients With Open Abdominal Surgery As There Have Been No Unfavorable Outcomes Recorded. Additionally, These Showed Improvement In Pulmonary Function And Exercise Tolerance.

In Addition; The Results Of The Present Study Were In The Same Line With **(Restrepo, 2011)** Who Stated That, The Most Recent Recommendation On The Utilization Of Incentive Spirometry In Avoiding

Postoperative Respiratory Complications Showed That This Element Ought To Be Used In Combination With Deep Breathing Techniques.

In The Present Study, Flow Incentive Spirometry Was Used In Combination With Diaphragmatic Breathing Exercise, Which Probably Contributed To Improved Post-Operative Respiratory Measures.

Similarly **(Carvalho, Et Al., 2011)** Reported That, The Methods Including Diaphragmatic Breathing Exercise & Incentive Spirometry Enhance The Buildup Of A Large And Sustained Increase In The Transpulmonary Pressure, Which Ensure Expansion Of The Collapsed Alveolar Units.

Furthermore Our Results Are In Accordance With The Findings Of **(Manzano, Et Al., 2008)** Who Found That, Diaphragmatic Breathing Exercise Was Able To Improve Pulmonary Mechanics And Lead To Beneficial Effect On Forced Vital Capacity (FVC).

As Well, **(Grams, Et Al., 2012)** Evaluated, The Effectiveness Of Diaphragmatic Breathing & Flow Incentive Spirometry Practice For The Avoidance Of Postoperative Pulmonary Complications And For The Recuperation Of Respiratory Mechanics And Found That Diaphragmatic Breathing Exercise Seemed, By All Accounts, To Be More Powerful

In The Same Context **(El-Marakby, Et Al., 2013)** Mentioned That, The Probable Cause Of The Improvement In Pulmonary Function In Patient Undergoing Upper Abdominal Surgeries Could Be The Utilization Of Incentive Spirometry, Which Is A Mechanical Gadget Used To Urge Patients To Take Long, Slow, Sustained Deep Inhalations Which Prompts Accomplishing Maximal Blowing Up Pressure In The Alveoli And Maximal Breathed In Volume, And Furthermore Keeps Up The Patency Of The Littler Airways. Postoperative Hypoxemia Is Diminished By Utilizing Incentive Spirometry Which Gives Low-Level Resistance Training To The Diaphragm And Minimizes Fatigue In This Way Enhancing Inspiratory Muscle Strength And Improve Lung Inflation.

These May Be The Causes Of Improved Post-Operative Respiratory Measures (Spo2 (%) Forced Vital Capacity (FVC) And Peak Expiratory Flow Rate (PEFR) In The Incentive Spirometry And Diaphragmatic Breathing Exercise Group As They Had The Benefits Of The Combined Effect Of Both Incentive Spirometry And Diaphragmatic Breathing Other Than One Of Them.

However These Findings Are Inconsistent With Those Of **(Gopala, 2016)** Who Stated That, Postoperative Pulmonary Function And Diaphragm Excursion Were Found To Be Better Preserved In Volume Incentive Spirometry And Diaphragmatic Breathing Exercise Group Than In The Flow Incentive Spirometry Group And The Control Group. Pulmonary Function And Diaphragm Excursion Showed Statistically Significant Differences Between Volume Incentive Spirometry And Diaphragmatic Breathing Exercise Group ($P < 0.05$) As Compared To The Flow Incentive Spirometry Group And The Control Group.

Regarding Comparison Between The Studied Groups And The Occurrence Of Post-Operative Pulmonary Complications, The Findings Of The Current Study Showed Decreased Incidence Of Respiratory Complications In The Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Group With Highly Statistical Significant Difference Between The Three Groups In Relation To Post-Operative Complications For Patients With Upper Abdominal Surgery. However The Result Of The Present Study May Be Far Away From **(Junior, Et Al., 2014)** Who Reported That, Non- Statistically Significant Differences Was Found Between The Participants Receiving Incentive Spirometry And Other Respiratory Measures Compared To Those Receiving Physiotherapy In The Risk Of Developing A Pulmonary Condition Or The Type Of Complication. There Was No Evidence That Incentive Spirometry Is Effective In The Prevention Of Pulmonary Complications.

As For The Length Of Hospital Stay And Patient Discharge, The Results Revealed Increased Percentage Of Patients Who Spent Less Than Three Days In Hospital And Patients Discharged To Home In The Incentive Spirometry & Diaphragmatic Breathing Exercise Group With Statistical Significant Difference Between The Three Groups .This Findings May Be Related To Improved Postoperative Respiratory Measures And Decreased Incidence Of Respiratory Complications In The Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Group.

According To (**Mccool, &Tzelepis, 2012)** The Postoperative Time Of Abdominal Surgery Is Accompanied With Impaired Respiratory Muscle Function And Impaired Physical Capacity, Which, Lead To The Occurrence Of Postoperative Pulmonary Complications. The Principle Changes That Prompt Post Pulmonary Complications As Diminished Diaphragm Movement, Depressed Central Nervous System, Changes In The Ventilation-Perfusion Proportion, Lessened Cough Adequacy, Higher Respiratory Rate, And Decreased Pulmonary Volumes And Capacities

As Regarding To Relation Between Mean Of The BMI & Surgery Duration & In The Three Studied Groups. The Finding Mentioned That There Was A Significant Correlation Between BMI And The Diaphragmatic Breathing Group, Flow Incentive Spirometer And (Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Group P= ($P<0.05$, $P<0.05$* & $P<0.001$) Respectively. Also The Study Findings Revealed A Significant Correlation Between Surgery Duration And Flow Incentive Spirometry & Diaphragmatic Breathing Exercise Group $P<0.001$.

The Results Of Our Study Achieve The Hypothesis By Application Of Both Flow Incentive Spirometry And Diaphragmatic Breathing Exercise In Upper Abdominal Surgery Patients Which Resulted In Improved Postoperative Pulmonary Measures, Decreased Incidence Of Respiratory Complications As Well As Decreased Length Of Hospital Stay.

VI. Conclusion & Recommendations

Based On The Results Of The Present Study, It Can Be Concluded That The Low Incidence Of Respiratory Complications In Diaphragmatic Breathing Exercise & Flow Incentive Spirometry Group With Significant Statistical Differences Were Found Between The Three Groups In Relation To Post-Operative Complications. Also, Statistically Significant Differences Between The Three Groups With Respect To Hospital Lengths Of Study. Based On The Results Of The Study We Strongly Recommend The Following:Both Diaphragmatic Breathing Exercise And Flow Incentive Spirometry Together Can Be Recommended Over Flow-Incentive Spirometry Alone Or Diaphragmatic Breathing Exercise Alone As An Intervention For The Improvement Of Pulmonary Function And Prevention Of Complications In The Patients With Upper Abdominal Surgery.

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