

A study of post operative pleuropulmonary complications of abdominal surgeries attending in a tertiary care hospital at Kakinada

M. Kiran^{1,*}, Sudha Prasuja Nakka³, Mohana Pradeepika⁴

¹Assistant Professor, ²Professor, ^{3,4}Post Graduate, Dept. of Pulmonary Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India

***Corresponding Author:**

Email: kirandr2014@gmail.com

Abstract

Introduction: Postoperative pulmonary complications (PPCs) following abdominal surgery are frequent and associated with increased morbidity and mortality and hospital length of stay. Incidence rates vary dramatically, ranging from 2% to 40%. The incidence of pleuro-pulmonary complications shows wide variations & has the diversity of various influencing factors, including patient existing lung conditions, habitual history, selection of surgery, anaesthetic risks and post-surgical recovery.

Material and Methods: 100 patients are selected from in & out patient department & causality in GGH, Kakinada attending for abdominal surgical conditions. It is a prospective- observational, cross sectional study.

Results: In the studied group of 100 person's total of 27 persons affected with pulmonary complications in overlapped manner. Following pulmonary complications observed with incidence rates respectively in the order of ATELECTASIS (74.07%), PLEURAL EFFUSION (62.96%), PNEUMONIA (62.96%), RESPIRATORY FAILURE (11.11%).

Conclusion: The incidence of postoperative pleuropulmonary complications of abdominal surgeries in our study in GGH, Kakinada is 27%, which includes atelectasis as the predominant one (74%) followed by pleural effusion and pneumonia each carrying equal incidence (62.96%) and finally respiratory failure that occupied least. Early prediction of postoperative pulmonary complications is possible to have the early interventions to reduce the post op morbidity, hospital length of stay and cost.

Keywords: Atelectasis, Pleural effusion, Pneumonia, Respiratory failure.

Introduction

"Postoperative pulmonary complications (PPCs) following abdominal surgery are frequent and associated with increased morbidity and mortality and hospital length of stay. Most investigators include postoperative pneumonia (confirmed or suspected), respiratory failure (usually defined as the need for ventilator support) and bronchospasm, but analysis of the literature shows that other complications, such as unexplained fever, excessive bronchial secretions, productive cough, abnormal breath sounds, atelectasis or hypoxemia, may also be included. The incidence of PPC varies depending on the clinical treatment setting, the kind of surgery studied, and the definition of PPC used. Incidence rates vary dramatically, ranging from 2% to 40%. The frequency of these complications has remained relatively constant due to the increased number and complexity of the operations performed and the increased acuity and age of patients[1].

The incidence of pleuro-pulmonary complications shows wide variations & has the diversity of various influencing factors, including patient existing lung conditions, habitual history, selection of surgery, anaesthetic risks and post-surgical recovery[2]. This study identified risk indicators for pulmonary complications after elective abdominal operations." It is interesting to see higher complication rates through the years despite new surgical techniques." Higher complication rates through the years may be a result of more aggressive surgeries defined for various malignant diseases. Pneumonia, ARDS, and respiratory failure

increased significantly over the time whereas atelectasis and pleural effusions decreased over time.

Aims and Objectives

1. To know the incidence of pleuro pulmonary complications of abdominal surgeries.
2. To know the association of risk factors to the post-operative pleuro pulmonary complications of abdominal surgeries.

Materials and Methods

100 patients are selected for the study, from in& out patient departments & causality in GGH, Kakinada attending for abdominal surgical conditions from august 2017 to august 2018.

Study design: it is a prospective- observational, cross sectional study.

Inclusion criteria: Patients included in the study are who selected for abdominal surgeries of age more than 18 years, fit for surgery, & assessed to be having post-operative pulmonary complications based on productive cough ,pyrexia ,respiratory distress, physical chest signs ,radiological evidence. ABG analysis

Exclusion criteria: 1. Patients with severe comorbid conditions, emergency surgical conditions where there is no scope for history taking and respiratory system assessment, associated with severe morbidity 2. Those who refused informed consent 3. Age below 18 years 4. Associated with cardiovascular risk factors.

Study Protocol: Hundred of such patients are selected for the study & detailed clinical history pertaining to

respiratory system, history regarding smoking, previous lung disease like asthma, COPD, pneumonia, pleural effusion is enquired. All the patients investigated with x ray chest, complete blood picture, spirometry, ABG analysis, sputum analysis, ultrasound chest, ECG and routine blood investigations and during the surgery duration of surgery & anesthesia, complications if any, the type of abdominal incision noted. In the early postoperative period recovery time, shifting time from resuscitation ICU, need for mechanical ventilation, and presence of nasogastric tube are noted. Differences in

the incidence rates of different complications are tested by chi square test for statistical significance.

Results and Observations

In the study group of hundred patients undergone for abdominal surgeries in GGH Kakinada the following pulmonary complications observed ATELECTASIS, PLEURAL EFFUSION, PNEUMONIA, RESPIRATORY FAILURE

Table 1: Percentage of complications in abdominal surgeries

Total surgeries	No of persons had complications	%
100	27	27

Table 2: Incidence rates of different pulmonary complications observed in post-operative period of abdominal surgeries. (Study group consists of 100 patients)

	Total no	Complication specific	%
Pleural effusion	27	17	62.96
Pneumonia	27	17	62.96
Atelectasis	27	20	74.07
Respiratory failure	27	03	11.11

Table 3: Association of age with pulmonary complications of abdominal surgeries (p value <0.05)

Age	Total No	Complications	%
<50	61	11	18.03
>50	39	16	41.02

Table 4: Association of SEX with pulmonary complications

Sex	Total no	No of persons with complications	%
Male	33	15	45.45
Femaie	67	12	17.91

The above observation denotes that the male sex is more prone for pulmonary complications as they are associated with more risk factors like smoking and alcoholism and other comorbidities

Table 5: Association of type of abdominal incisions with post-operative pulmonary complications

Type of incision	Total no	No of persons with complications	%
High	45	19	42.22
Low	55	08	14.54

Table 6: Association of smoking with post-operative pulmonary complication following abdominal surgeries

Category	Total no	No of persons with complications	%
Smokers	41	18	43.90
Non smokers	59	09	15.25

Table 7: Association of pre-existing lung diseases with post-operative pulmonary complications following abdominal surgeries

Association with pre-existing respiratory diseases(BA,COPD) disease	Total no	No.	%
With	37	17	45.94
Without	63	10	15.87

Table 8: Association duration of surgeries with the development of postoperative pulmonary complications

Duration of surgery	Total number of persons	Persons with complications	%
<210 minutes	70	17	24.28
>210 minutes	30	10	33.33

Table 9: Showing different pulmonary complications and combinations of more than one complications and their percentages in total complications

	Complications	No. of persons	%
1	Pleural effusion only	01	3.07
2	Atelectasis only	04	14.8
3	Pneumonia only	02	07.4
4	Pleural effusion + pneumonia	02	07.4
5	Pleural effusion + atelectasis	04	14.8
6	Respiratory failure + atelectasis	01	3.70
7	Respiratory failure + pneumonia	02	07.4
8	Pleural effusion + pneumonia + atelectasis	10	37.0
9	Pneumonia + atelectasis	01	3.7
	Total	27	

Table 10: Association sex with complications

Sex	Total no. of persons	Pleural effusion	Atelectasis	Pneumonia	Respiratory failure
Males	33	09 (27.2%)	12 (36.36%)	10 (33.30%)	02 (13.33%)
females	67	08 (11.9%)	08 (11.94%)	07 (10.44%)	01 (8.33%)

Table 11: Association of age with complications

Age	Total no. of persons	Pleural effusion	atelectasis	pneumonia	Respiratory failure
< 50	61	06 (9.83%)	07 (11.47%)	07 (11.47%)	00 (00%)
>50	39	11 (28.20%)	13 (33.33%)	10 (25.64%)	03 (7.69%)

Table 12: Association of abdominal incision with complications

Type of Incision	Total no. of persons	Pleural effusion	Atelectasis	Pneumonia	Respiratory failure
High	45	12 (26.66%)	14 (31.11%)	16 (35.55%)	03 (6.66%)
Low	55	05 (9.09%)	06 (10.90%)	01 (1.81%)	00 (00%)

Table 13: Association of smoking with complications

	Total no. of persons	Pleural effusion	Atelectasis	Pneumonia	Respiratory failure
Smokers	41	12 (29.26%)	15 (36.58%)	12 (29.26%)	03 (7.31%)
Non smokers	59	05 (8.47%)	05 (8.47%)	05 (8.47%)	00 (00%)

Table 14: Association of lung disease with complications

Lung diseases (BA, COPD)	Total no. of persons	Pleural effusion	Atelectasis	Pneumonia	Respiratory failure
Yes	37	12 (32.43%)	15 (40.54%)	12 (32.43%)	03 (8.10%)
No	63	05 (12.85%)	05 (7.93%)	05 (7.93%)	00 (00%)

Table 15: Association of duration surgery with complications

Minutes	Total no. of persons	Pleural effusion	Atelectasis	Pneumonia	Respiratory failure
< 210	70	09 (12.85 %)	12 (17.14%)	09 (12.85%)	01(3.33%)
>210	30	08 (26.66 %)	08 (26.66 %)	08 (26.66%)	02 (2.85%)

Discussion

Preoperative assessment[3] of patients scheduled to undergo upper abdominal surgery assists the physician in determining preoperative risk. Physiological changes that occur after laparotomy[8], including alterations in lung volume, ventilatory gas exchange and respiratory defense mechanisms, impose an increased risk of pulmonary complications[5] for susceptible patients. In this study we observed a PPC incidence of 27% (27/100). However, other studies have shown a wide variation, between 10 and 80% in the incidence of PPCs following abdominal surgery, because there is no standard definition of PPC's and also interplay of multiple risk factors. In this study the relatively low incidence of pulmonary complications was due to the fact that patients was undergoing prophylactic measures to avoid such complications.

1. Atelectasis is the most frequent complication observed in our study (74% = 20/27). It was associated with pleural effusion and not occurred alone. More than one complication is frequently observed in the same patient at the same time. Only four of our patients affected with atelectasis alone and rest of others affected in combination with pleural effusion, pneumonia, respiratory failure. The association of pleural effusion with atelectasis showed 51.85% which signifies the strong interrelationship of both conditions. Most atelectasis occurs near diaphragm in supine posture and less towards the apex. with cardiopulmonary by pass atelectasis is more prominent than after other forms of surgery even thoracotomies. Increasing FiO₂ at the end of surgery to 1.0 before extubation will favour atelectasis formation, persisting in postoperative period[5]. Using 80% oxygen compared with 30% reduces the incidence of postoperative nausea and vomiting from 30% to 17%. More importantly use of 80% oxygen during colorectal resection halved the incidence of surgical wound infection compared with FiO₂ of 0.3. Most of the atelectasis appearing during general anaesthesia[4] resolves within 24hrs after surgery. **A Vital Capacity Maneuver (VCM)** can completely abolish atelectasis that develops after induction of general anaesthesia. an airway

pressure of 30 cm H₂O reduces atelectasis, only with a pressure of 40cm H₂O maintained for 15secs atelectatic lung tissue fully expand. this maneuver has been called the VCM. Use of bilevel positive airway pressure (BiPAP) system to treat obese patients for the first 24 hrs after upper abdominal surgery significantly reduced pulmonary dysfunction[13].

- 2. Pulmonary infection** (pneumonia or tracheobronchitis) accounted for 62.96% percent (17/27) of the patients with PPCs. 11.11 percent of these patients (03/27) developed acute respiratory failure with prolonged intensive care treatment and hospitalization. Studies have found that 40 to 60 % of ambulatory patients would be defined as "high risk" for aspiration pneumonitis, use of metoclopramide in combination with a H₂-antagonist has been advocated to decrease postoperative emesis and further reduction in the risk of aspiration pneumonitis. Treatment should include intubation and ventilation if respiratory failure is severe. Broad spectrum coverage is prudent. Specific coverage with antibiotics is dictated by culture results [7]. The incidence of respiratory tract infection in patients requiring an endotracheal tube can be as high as 17 to 20 %.78, 79 Approximately 60% of nosocomial infections are caused by aerobic gram-negative bacteria and 20% are caused by viral infection (an important source of morbidity and mortality in immunocompromised patients). Ventilators and breathing circuits are heavily contaminated with microorganisms from the patient's oropharynx and trachea. Therefore, disposable circuits or disinfection of components used in the breathing system is equally effective in preventing cross infection between patients. Pulmonary toilet and culture-specific antibiotic remain the basic treatment plan. Initially, coverage with broad-spectrum antibiotics may be needed until microbiology results are known, but then a tailored antibiotic regimen is strongly recommended.
- 3. Pleural effusion** also running parallel to the atelectasis with complication rate of 62.96%. The Effusions are all disappeared spontaneously over

the subsequent 3 to 12 days without any specific therapy, with the exception of the infected effusion in some patients. Perfusion lung scans done in some individuals with larger effusions (over 10 mm thick) did not demonstrate segmental filling defects suggestive of pulmonary embolism. There are many possible causes for postoperative pleural effusions. Hypervolemia during or after surgery leads to transudate effusion[9]. The pancreas may be manipulated during the surgery, leading to pancreatitis and a resultant pleural effusion; the amylase level in the pleural fluid should be elevated, and since in only two of the larger effusions was it elevated slightly, it appears that pancreatitis accounts for very few of the effusions in the present series. The effusions associated with subphrenic abscess usually do not become manifest until about ten days after surgery.¹⁰ The significant ($P < 0.01$) relationship between the presence of atelectasis and pleural fluid in our series suggests that one of these two mechanisms is operative. If increased negative pleural pressure is the explanation, a transudative pleural effusion should result. Conversely, if pneumonitis is the explanation, the pleural effusion should be an exudate[12]. Unfortunately, since most of the effusions were too small to examine, it is impossible to say which mechanisms predominate. The presence of free peritoneal fluid at the time of surgery appeared to be related to the postoperative development of pleural fluid. The present study shows that pleural effusions frequently occur in the first few days after abdominal surgery[13]. They are related in most instances to atelectasis, peritoneal fluid, or irritation of the diaphragm. Their development should not be regarded as a serious complication, as almost all resolve spontaneously. When effusions occur, a diagnostic thoracentesis to rule out pleural infection should be performed. A low pH (<7.20) in the pleural fluid is a sensitive indicator that pleural infection is present. Some pleural effusions might be related to postoperative sodium and water retention, and aggravated by an age-related relative cardiac decompensation. Early postoperative pleural effusions are common and do not require specific treatment.

4. **Respiratory failure** is being occupying 3.7% in association with atelectasis and 7.4% in combination with pneumonia[14]. We found the smoking habit, age >50 , high abdominal incisions, associated lung diseases complicated the other complications with respiratory failure [15]. It has been suggested that respiratory muscle dysfunction may be responsible for a number of pulmonary complications. The side of the operation, as well as the type, are the most important factors affecting the respiratory muscles.

the incidence of significant respiratory muscle dysfunction after lower abdominal surgery[16] is very low (2–5%) while that of upper abdominal surgery may approach 20–40%. Respiratory muscle dysfunction may play a significant role in the breathing pattern. The decrease in maximum inspiratory, transdiaphragmatic, and expiratory muscle pressures observed after upper abdominal surgery in several studies. This decrease is sustained for 48 hours after surgery and may persist for a week, gradually returning to normal. Although anaesthesia and pain may be responsible for dysfunction of the respiratory muscles, studies in animals and humans support the hypothesis that an inhibitory reflex generated during the surgical procedure is the major mechanism. This reflex inhibition of the phrenic nerve output has been postulated to be elicited by the manipulation of the gallbladder and other splanchnic organs.

The main factors traditionally associated with PPCs are chronic airways disease, advanced age, upper abdominal surgery, prolonged duration of surgery, history of smoking, and obesity[10]. To select the risk factors to be included in logistic regression for PPC we chose the variables based on p value of the chi square test in a stepdown significance procedure. The variables were included in the following sequence: previous lung disease ($p = 0.0001$), respiratory symptoms ($p = 0.0001$), comorbidity ($p = 0.007$), age over 50 years old ($p = 0.03$), surgery duration over 210 minutes ($p = 0.03$), habitual smoking ($p = 0.04$), current smoking ($p = 0.04$) and obesity ($p=0.10$)[11]. The logistic regression in our study showed the same risk factors as found in the literature. We found that the presence of chronic pulmonary disease is also strongly associated with PPCs, particularly if the patient's surgery lasted longer than 210 minutes and comorbidity was present. **Old age beyond 50 years** increase the incidence of pulmonary complications[17]. The possible explanation for this may be: (a) decrease in static lung volume, (b) diminished MEFR, (c) reduced pulmonary elastic recoil, (d) reduction in PaO₂. Development of pulmonary complications seems to be more in **males (55.55%)** than in **females (44.45%)** possibly due to smoking habits[19] of men, more dependency of diaphragmatic breathing and bronchial "catarrh". Although **obesity** is a recognised risk factor, most of our patients belonged to the lower socioeconomic strata; hence no firm conclusion could be drawn. Only four patients in our group were obese and developed pleural effusion with atelectasis, two of them developed respiratory failure as an additional complication and wound dehiscence.

Conclusion and Summary

The incidence of postoperative pleuropulmonary complications of abdominal surgeries in our study in GGH, Kakinada is 27%, which includes atelecais as

the predominant one (74%) followed by pleural effusion and pneumonia each carrying equal incidence (62.96%) and finally respiratory failure that occupied least. Early prediction of postoperative pulmonary complications is possible to have the early interventions to reduce the post op morbidity, hospital length of stay and cost[20].

References

1. Lee J, Larson R, Buckley J et al. Airway maintenance in morbidly obese. *Anesth Rev* 1980;7:33.
2. Warner DO. Preventing postoperative pulmonary complications: the role of anesthesiologist. *Anesthesiol* 2000;92:1467-72.
3. Smetana GW. Preoperative pulmonary evaluation. *N Engl J Med* 1999;340:937-44.
4. Pedersen T, Viby-Mogensen J, Ringsted C. Anaesthetic practice and postoperative pulmonary complications. *Acta Anaesthesiol Scand* 1992;36:812-18.
5. Arozullah AM, Conde MV, Lawrence VA. Preoperative evaluation for postoperative pulmonary complications. *MedClin N Am* 2003;87:153-73.
6. Arozullah A, Daley J, Henderson W et al. Multifactorial risk index for predicting postoperative respiratory failure in men after noncardiac surgery. *Ann Surg* 2000;232:243-53.
7. Arozullah AM, Khuri SF, Henderson WG et al. Development and validation of a multifactorial risk index for predicting postoperative pneumonia after major noncardiac surgery. *Ann Intern Med* 2001;135:847-57.
8. Ondrula DP, Nelson RL, Prasad ML, Coyle BW, Abcarian H. Multifactorial index of preoperative risk factors in colon resections. *Dis Colon Rectum* 1992;35:117-22.
9. Gibbs JPC, Henderson W, Daley J, Hur Kwan MS, Khuri, Shukri F. Preoperative serum albumin level as a predictor of operative mortality and morbidity: results from National VA Surgical Risk Study. *Arch Surg* 1999;134:36-42.
10. Kroenke K, Lawrence VA, Theroux JF, Yuley MR. Operative risk in patients with severe obstructive pulmonary disease. *Arch Intern Med* 1992;152:967-71.
11. Moller AM, Mssloe R, Pedersen T. Postoperative intensive care admittance: the role of tobacco smoking. *Acta Anaesthesiol Scand* 2001;45:345-48.
12. Thomas DR, Ritchie CS. Preoperative assessment of older adults. *J Am Geriatr Soc* 1995; 43: 811-21.
13. Brooks-Brunn JA. Predictors of postoperative pulmonary complications following abdominal surgery. *Chest* 1997;111:564-71.
14. Gupta H, Gupta PK, Fang X, Miller WJ, Cemaj S, Forse RA, Morrow LE. Development and validation of a risk calculator predicting postoperative respiratory failure. *Chest* 2011;140(5):1207-15. Epub 2011 Jul 14.
15. Svensson LG, Hess KR, Coselli JS, Safi HJ, Crawford ES. A prospective study of respiratory failure after high-risk surgery on thoracoabdominal aorta. *J Vasc Surg* 1991;14:271-82.
16. Ebert JP, Grimas B, Niemann KMW. Respiratory failure secondary to homologous blood transfusion. *Anesthesiol* 1985;63:104-6.
17. Development and Validation of a Multifactorial Risk Index for Predicting Postoperative Pneumonia after Major Noncardiac Surgery Ahsan M. Arozullah, MD, MPH; Shukri F. Khuri, MD; William G. Henderson, PhD; and Jennifer Daley, MD, for the Participants in the National Veterans Affairs Surgical Quality Improvement Program
18. Eagle KA, Berger PB, Calkins H. ACC/AHA guideline update for postoperative cardiovascular evaluation for noncardiac surgery: executive summary: a report of American College of cardiology, American Heart association Task Force on Practice Guidelines (Committee to update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *J Am Coll Cardiol* 2002;39:542-53.
19. Warner MA, Divertie MB, Tinker JH. Preoperative cessation of smoking and pulmonary complications in coronary artery bypass patients. *Anesthesiol* 1984;60:380-83.
20. Smetana GW. Evaluation of preoperative pulmonary risk (Up to date review) Up To Date 2003;10: N3. <http://www.uptodate.com> (accessed Jun 30,2005).

How to cite this article: Kiran M, Nakka S. P, Pradeepika M. A study of post-operative pleuropulmonary complications of abdominal surgeries attending in a tertiary care hospital at Kakinada. *Indian J Immunol Respir Med.* 2018;3(4):217-222.