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Risk factors and Outcomes of post operative pulmonary complications after laparotomy surgeries: a retrospective observational cohort study in south india.

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Abstract:
Background: *One of the most common cause of post operative morbidity and mortality in abdomen surgeries is pulmonary complications.The aim of the study is to analyze the clinical profile, Risk factors, incidence and outcomes of postoperative pulmonary complications in patients submitted to abdominal surgeries and admitted in Andhra medical college.*
Methods: *From January 2018 to December 2020 we have conducted a retrospective, observational study of inpatients who underwent elective and emergency surgeries in Andhra medical college, General Surgery Department. We evaluated the perioperative risk factors and associated mortality. Logistic regression was performed to find which perioperative risk factors were most important for the occurrence of PPCs.*
Results:*328 patients who were submitted to elective and emergency abdominal surgeries were included in the study. 72 % of the patients were male and 28% of patients were female. Median age of the patients is 56.3 years. Basal lung Atelectasis was the commonest cause of the PPC in this study. 86 patients (70.4%) patients developed PPCs within 48 hrs and 36 patients (29.6%) of the patients developed PPCs after 48 hours. upper abdominal surgeries carried the highest risk of PPCs. Emergency abdominal surgeries carried higher risk than Elective abdominal surgeries.*
Conclusions*: PPCs are a major problem as they cause high morbidity, mortality and longer length of in-hospital stay. Our study concludes that Upper abdominal surgeries carry highest risk for PPCs. Emergency abdominal surgeries are associated with higher risk of PPCs than Elective abdominal surgeries.*
Keywords: *Abdominal surgery, Acute respiratory failure, mechanical ventilation, Postoperative pulmonary complications*

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I. Introduction

Post operative pulmonary complications occur with a higher frequency that cardiac complications in abdominal surgery cases[1]. Approximately 16% of all patients who undergo major surgery suffer with a pulmonary complication[2]. The frequencies of the pulmomary complications after surgery has been varying widely[3]. The reason for the variability may be patient selection, differences in surgical procedure. One of the under reported complications are post operative pulmonary complications that are costly and increase patient mortality[4]. Immediately after general anesthesia many changes occur in respiratory system that explain the majority of PPCs[5]. the respiratory drive and muscle function are altered, lung volumes are reduced, and thereby atelectasis develops in most of the cases[6]. Acute respiratory failure is common in abdominal surgeries and in some its severity may lead to the need of mechanical ventilation[7]. Many risk factors contribute to the occurrence of the respiratory complications in postoperative period like obesity, nutritional deficiencies, previous respiratory pathology[8]. If we can identify the risk factor for PPCs early, we can intervene early and can increase the survival of the patients[9].

II. Methods And Methods:

This study is done at King George Hospital, General surgery Department from January 2018 to December 2019.The hospital is a Tertiary government teaching Institute with a capacity of 1237 beds. The hospital serves the needs of north coastal Andhra Pradesh and also adjacent Orissa. The study was approved by the internal Ethics Committee of Andhra Medical College. All patients received standard clinical care and no research related intervention was introduced. PPCs were defined by the occurrence of any respiratory pathology in the first week of the postoperative period like pneumonia, atelectasis, pleural effusion, exacerbation of preexisting lung disease, sepsis with ARDS, pulmonary edema. Data regarding occurrence (<48hrs and >48hrs)

of clinically significant PPCs was collected using clinical, laboratory, and radiological features of PPCs. Perioperative Risk factors were evaluated including age, gender, body mass index, history of respiratory illness like COPD, type of anesthesia, type of incision, duration of surgery, elective or emergency. Physician notes, orders, anesthesia records, operative reports, diagnostic studies and pathology reports were examined. Hospital Length of stay(LOS), postoperative LOS, and frequency of ICU care were assessed.Data was entered into Excel sheet.

Inclusion criteria :

all adult patients > 18 years old undergoing abdominal surgery.

open abdominal surgery

Exclusion criteriae :

Laparoscopic procedures

Inguinal hernia repairs

Retroperitoneal procedures.

Trauma surgeries.

All Statistical analysis was performed using SPSS version 15. Continuous variables were described using median, range or mean ± standard deviation, and categorical variables were expressed as frequencies or percentages. Continuous variables were compared using student's t test. For comparing categorical data Fisher's exact test were used. A p-value< 0.05 was considered to be statistically significant.

III. Results

During the entire 24 months of the study, 1731 operations were performed in the department. 328 abdominal surgeries were done. All were performed under general anesthesia. The type of the surgeries that were performed is shown in table 1.

Table 1: Operative procedures in 328 abdominal surgeries.

Type of the surgery	n	PPCs
Appendectomy	43	0
Bowel Resection(Large or Small Bowel)	147	49
Exploratory laparotomy	39	14
Gall bladder surgeries	53	19
Whipples procedure	8	5
Peritonitis	31	10
Pancreatectomy	4	2
Splenectomy	2	1
Diaphragmatic hernia	1	1
Lysis adhesis	46	21

The mean age of the patient is 57.3 years. 87(71.31%) were males and 35(28.68) were females fig 1. Within 48 hrs 86 patients developed PPCs and 36 patients developed PPCs after 48 hrs fig 2. Emergency surgeries done were 59(48.3%) and elective surgeries were 63(51.63). Invasive mechanical ventilation was needed in 29 PPCs patients. The types of PPCs are shown in table2.

Table 2: Types of PPCs in abdominal surgeries.

Atelectasis	22
Pneumonia	36
Pneumothorax	3
Pleural effusion	25
Copd exacerbations	13
Asthma exacerbations	9
Pulmonary Embolism	2
ARDS	12

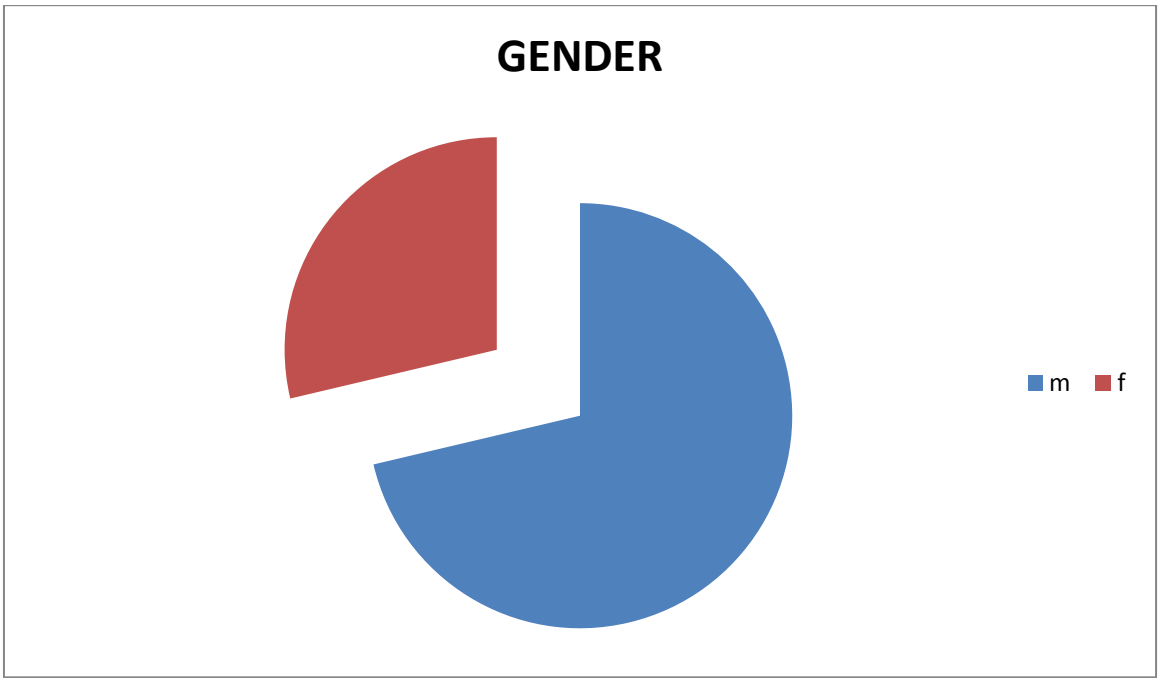
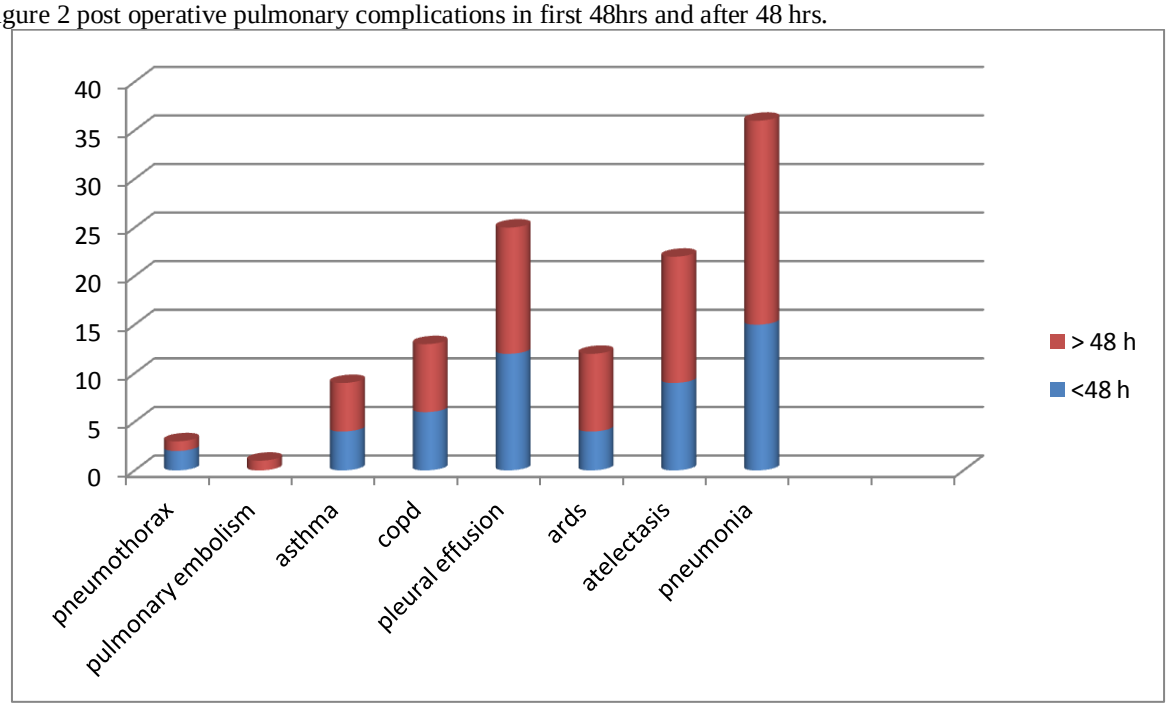


figure 2 post operative pulmonary complications in first 48hrs and after 48 hrs.



pneumonia was the most common PPC that was seen. Among patients developing PPCs with in 48 hrs the complications were 1pneumothorax, 4 asthma, 4 copd, 10 pleural effusions, 4 ARDS, 9 atelectasis and 12 pneumonia. In those developing PPC after 48 hrs the complications were 2 pneumothorax, 1 pulmonary embolism, 5 asthma, 9 copd, 15 pleural effusions, 8Ards, 13 Atelectasis and 24 pneumonia.
Etiologies with PPCs are depicted in the table 3.

Table 3:

Etiology	Patients, (n,%)	Emergency surgery (n,%)		Elective surgery (n,%)	
		<48 h	>48h	<48 h	>48 h
Peritonitis	31(37.8)	12	2	8	9
Bowel obstruction	17(20.7)	5	4	7	1
Abdominal trauma	11(13.4)	4	1	5	1
Acute pancreatitis	4(4.8)	2	0	1	1
Cholilithiasis	25(30.5)	7	3	9	6

Cholangiocarcinoma	7(8.5)	3	1	2	2
Cholecystitis	21(25.6)	9	3	8	2
Mesenteric ischemia	2(2.4)	2	0	0	0
Abdominal TB	4(4.88)	2	0	1	0

The consequences of the PPCs are also significant with In-hospital mortality of 17% after PPCs vs 2% without PCCs. There were 11 deaths in those requiring mechanical ventilation. There was 5-fold increase in mortality risk after PPCs. Mechanical ventilation was required in 26 (31.7%) of 122 PPCs cases as compared to 11 (0.033%) of 206 non PPCs abdominal surgery cases. ICU management was needed in 77(63.1%) laparotomies with PPCs cases when compared to 27(13.1%) abdominal surgeries without PPCs. The risk of ICU management was 14-fold greater after PPCs (OR 14.0; CI 4.80-35.9; P= 0.002). Mean hospital LOS was 19.2 days longer and the mean postoperative LOS was 13.4 days longer after PPCs(p=0.003) when compared to abdominal surgeries without PPCs.

Risk factors associated with PPCs identified by logistic regression modeling are depicted in table 4.Upper abdominal surgeries are 18 times associated with PPCs than lower abdominal incision. The risk is 8 times higher for the emergency procedure than elective procedure (p=0.002). Pre existing lung disease is also associated with risk.

Table 4: Risk factors associated with PPCs in 328 Abdominal surgeries.

Risk Factor	PPCs(n=)	No PPCs(n=)	P value
Mean age± SE, yrs	53.7 ±3.35	46.3 ± 4.53	0.03
Male gender	87(71.3%)	112(54%)	0.31
Emergency surgery	52(48.3%)	46(22.3%)	0.002
Upper abdominal incision	91(74.5%)	63(30.5%)	0.003
Smoking	86(70.4%)	53(25.7%)	0.16
Alcoholism	93(76.2%)	41(19.9%)	0.04
History of lung disease	13(10.6%)	23(11.2%)	0.02

IV. Discussion

In this study we tried to evaluate the profile of PPCs in a population that is submitted to abdominal surgery in tertiary hospital in Visakhapatnam. We observed that PPCs occur within 48 hrs in 70% of the abdominal surgical cases which needed ICU care. We found 7.04 % is the incidence of the PPCs after laparotomy. A study of incidence of postoperative pulmonary complications of non thoracic surgeries has shown the incidence as 2.7%[10]. Another study done in US between 1989 and 2004 showed the incidence of PPC to be 6.5%. Independent risk factors for the PPCs that were found are upper abdominal incision, emergency surgery[11]. Patients operated for peritonitis had the highest rate of PPCs in the emergency settings, whereas in the elective settings patients operated for malignancies are more prone for PPCs. Serejo et al reported a 28.2% incidence of pulmonary complications, similarly Kumar et al showed 16% as the incidence of PPCs among the patients undergoing abdominal surgeries in emergency[12´13]. These findings were similar to our study. We also included exacerbation of pre-existing lung disease which was not routinely assessed in prior studies.10.65 %(13) of PPCs in our study were exacerbations of underlying disease. Our study also included events affecting key outcomes including serious morbidity, mortality and length of stay. One of the limitation of our study is PPCs of first week are only included in the study. This is because events after first week are less likely as laparotomy reduces diaphragmatic function by inhibiting phrenic nerve output during first postoperative week[14].

Our study also confirms that procedure related factors than patient related factors have the largest impact. Upper abdominal incisions impose a higher risk for PPCs than lower incisions[14]. More profound reflexive inhibition of the diaphragmatic fuction after upper abdominal procedure is believed to be the mechanism[15]. A study of 560 gyneacology surgery cases showed lower risk after lower abdominal incision[16].

The consequences of PPCs were very considerable. In-hospital mortality, ICU care, hospital LOS, and post-operative LOS all increased significantly due to PPCs. A similar study previously done by Lawrence et al reported in hospital mortality of 22% after elective laparotomy[17]. Fiolardo Fe A et al showed a mortality of 20.3% in patients undergoing upper abdominal surgeries experiencing PPCs[18].Our study also showed a significant association of PPCs with death, longer stay in hospital in the postoperative period and increased utilization of the ICU beds.

Limitation of our study is that it was based on the chart reviews, so it is subject to all the limitations of the retrospective studies. Another limitation is that some surgeries like hepatectomy, organ transplantations were not available for the study as they are not done in our Hospital.

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