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Updated Review of Pulmonary Complications after Aortic Surgery: Systematic Review

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Abstract: **Postoperative lung problems (PPC) prevail, severe conditions highly associated with an increased morbidity after major non-cardiac surgery. In fact the incidence of PPC is very just like the incidence of cardiovascular complications in patients going through non-cardiac surgery and greatly adds to increase postoperative length of hospital stay and costs. Pay Per Click have actually been extensively specified as pneumonia, aspiration pneumonitis, respiratory tract infection, respiratory failure, atelectasis, pleural effusion, pneumothorax, bronchospasm and so on. Database searches yielded a total of 6 229 articles. Excluding 5870 non-pertinent titles or abstracts, we recovered in total form and assessed 359 studies according to the selection criteria. Due to the fact that of our prespecified exemption requirements, one hundred forty-six research studies were further left out.Despite several studies on long-term and short outcome after open abdominal aortic surgery have been published so far, few of them focused on PPC. Moreover, most of published literature didn't concentrate on the identification and classification of PPC, since "unspecified respiratory complications" was the largest reported category, incredibly accounting for 48,412 events (22.9% of patients), while pneumonia only for 4598 events (7.6% of patients).**

Nonetheless, literature clearly shows that incidence of PPC after open abdominal aortic surgery is extremely high and strongly contributes to increase postoperative morbidity and mortality of patients undergoing vascular surgery procedures.

The aim of this systematic review was to obtain a photo of the real incidence of PPC after open abdominal aortic surgery and the effect on survival.

Keywords: **Postoperative lung problems (PPC), abdominal aortic surgery.**

1. INTRODUCTION

Postoperative lung problems (PPC) are among the most regular issues after non-cardiac surgery. Male, cigarette smokers, elderly patients with persistent obstructive lung disease or cardiac arrest are most likely to experience PPC. Most of patients going through vascular surgery belong to these classifications and are at higher danger of developing PPC. Surgical site is one of the most important threat factors associated with PPC and aortic surgery brings the greatest risk. The objective of this systematic review was to obtain a more understanding of the real incidence of PPC after open abdominal aortic surgery and the effect of PPC on survival.

Postoperative pulmonary issues (PPC) prevail, extreme conditions strongly connected with an increased morbidity after significant non-cardiac surgery [(1)]. In reality the occurrence of PPC is very similar to the incidence of cardiovascular issues in patients going through non-cardiac surgery and heavily contributes to increase postoperative length of hospital stay and expenses[(2)].

PPC have been extensively defined as pneumonia, goal pneumonitis, respiratory tract infection, respiratory failure, atelectasis, pleural effusion, pneumothorax, bronchospasm and so on.

Surgical site is one of the most crucial threat aspects connected with the advancement of PPC[(3)]. In specific abdominal aortic surgery, together with upper abdominal and thoracic treatments, carries the highest danger[(4,5)]. The distance of the

skin cut to the diaphragm appears to have an important role in the advancement of PPC[6,7]. In reality, a number of research studies revealed that, in patients going through upper abdominal surgery, a decline in diaphragmatic motility results in lowered ventilation and growth of the reliant lung zones[6,7]. In this regard, several current systematic reviews and meta-analyses proved that preoperative physiotherapeutic manoeuvres, inspiratory muscle training and workout therapy could help to lower the incident of PPC[8,9].

More over male patients, smokers, older patients and those with a history of chronic obstructive lung disease or congestive heart failure are most likely to experience PPC[5]. The bulk of patients going through vascular surgery come from these categories and, therefore, are theoretically at higher risk of developing PPC[10,11].

The aim of this systematic review was to obtain a photo of the real incidence of PPC after open abdominal aortic surgery and the effect on survival.

2. METHODOLOGY

Literature search was independently carried out on several databases (BioMedCentral, PubMed, Embase, and the Cochrane Central Register of clinical trials) by 4 investigators. Research study was upgraded on November 1th 2014.Mesh of words that were used: Aortic Aneurysm; Abdominal; Postoperative Complications; Postoperative Pulmonary Atelectasis . The complete PubMed search technique aimed to consist of all retrospective or potential (either randomized or observational) publications reporting information on PPC after open abdominal aortic surgery and is presented in the Supplemental Material. (Supplemental Material) References were first individually examined at a title/abstract level by 4 investigators then, if possibly relevant, retrieved as complete short articles. The exemption criteria were: absence of data on PPC; studies consisting of thoracoabdominal aortic surgery; laparoscopic surgery; duplicate publications. Compliance to selection requirements and selected research studies for the final analysis were individually assessed by two detectives, with divergences finally fixed by agreement. If 30-days mortality was not reported), perioperative death was thought about as 30-days or in-hospital mortality (PPC were categorized as pneumonia, respiratory insufficiency, extended postoperative mechanical ventilation, need for unexpected mechanical ventilation (noninvasive or intrusive), atelectasis, Acute Respiratory Distress Syndrome (ARDS), lung edema, pleural effusion, hypoxia, undefined breathing issues. Categorization of PPC was accepted based on authors definition.

3. RESULTS AND DISCUSSION

Study Characteristics:

Database searches yielded a total of 6 229 articles. Excluding 5870 non-pertinent titles or abstracts, we recovered in total form and assessed 359 studies according to the selection criteria. Due to the fact that of our prespecified exemption requirements, one hundred forty-six research studies were further left out.

The final 213 manuscripts included an overall of 269 637 patients. References of included research studies are presented in Supplemental Material. (Supplemental Material). Average variety of consisted of topics was 145 [68-391] Forty-four studies were prospective (15 randomized and 29 observational) while 169 retrospective. Fifty-two of the included research studies were multicenter. One hundred forty-two research studies were carried out on elective interventions and 38 studies included just urgent procedures while the staying 33 studies, 13 of which were randomized, consisted of both elective and immediate surgery patients. Only ten of the included manuscripts focused on PPC, three which were randomized.

Quantitative Data Synthesis:

Released studies reporting PPC after aortic surgery typically organized together different unspecified events just defining them "pulmonary issues".

Required for unplanned invasive or noninvasive mechanical ventilation, hypoxia, atelectasis, pneumonia, pleural effusion, pulmonary edema, extended postoperative mechanical ventilation, acute respiratory distress syndrome and respiratory insufficiency are the most typical pulmonary problems reported in literature (Table 1).

Table 1: Incidence of pulmonary complications in patients who underwent open abdominal aortic surgery, divided into elective and urgent procedures

		Overall			Elective			Urgent	
Pulmonary Complication	Included studies, n°	Included patients, n°	Reported events, n°	Included studies, n°	Included patients, n°	Reported events, n°	Included studies, n°	Included patients, n°	Reported events , n°
Pneumonia	104	60 482	4 598	76	48 110	3,006	19	5 064	1 241
Respiratory Insufficiency	51	24 757	2 090	35	21 843	1,737	13	2 052	311
Prolonged Postoperative MV	42	19 255	2966	29	15 356	1536	12	3819	1420
Need For Unplanned MV (Invasive Or NIV)	24	27 854	2052	19	24 924	1740	4	2805	306
Atelectas Is	18	4446	58	10	2670	32	4	623	26
Ards	12	3293	58	8	868	52	1	48	11

Overall median incidence of PPC was 10.3% ranging between 9.48% in elective procedures and 22.9% 10.0-35.7 in urgent surgery patients. (Table 1) The most frequent respiratory complications were hypoxia (10.8% 7.89-42.2, prolonged mechanical ventilation (10.7% 3.46-23.0, and pneumonia (7.30% 4.17-15.0).

Occurrence of PPC was associated with increased perioperative (28-days or in-hospital) mortality (R= 0.65 p< 0.01), both in elective (R= 0.724; p< 0.01) and urgent (R= 0.738; p< 0.01) surgery patients. (Table 2).

Two hundred and two of the included studies reported perioperative mortality. Overall median mortality rate was 4.50% , ranging between 3.49% in elective procedures and 38.0% 25.7-44.8 in urgent surgery patients. Univariate analysis between specific pulmonary complications and mortality is presented in Table 2.

Notably, pneumonia and prolonged postoperative mechanical ventilation resulted to be individually related to increased perioperative mortality of patients undergoing both urgent and elective procedures. (Table 2) PPC (RR= 0.38 , p for effect <0.001, p for heterogeneity = 0.015, I2 = 52%) were significantly more common in urgent surgery patients than in elective surgery ones. Similarly, mortality rate was significantly higher in patients who underwent urgent procedures (RR= 0.16 95% CI 0.10 to 0.27, p for effect <0.001, p for heterogeneity <0.01, I2 = 93%).

Incidence of mortality and postoperative pulmonary complications reported in literature did not vary over time of publication (R= 0.03, p= 0.6; R= 0.05, p= 0.4 respectively). Moreover, a cumulative meta-analyses showed no differences on the effect of pulmonary complications on survival over the years.

Meta-regression analyses revealed no significant effects both for pulmonary complications and mortality.

Table 2 Univariate correlation between respiratory complications and perioperative mortality

			Mortality			
	Overall Rho	p-value	**Elective** Rho	p-value	**Urgent** Rho	p-value
Pneumonia	0.660	p<0.01	0.694	p<0.01	0.773	p<0.01
Respiratory Insufficiency	0.628	p<0.01	0.614	p<0.01	0.484	NS
Postoperative Prolonged MV	0.650	p<0.01	0.639	p<0.01	0.720	p<0.01
Need for unplanned MV/NIV	0.888	p<0.01	0.905	p<0.01	*	*
Atelectasis	0.333	NS	0.585	NS	*	*
ARDS	0.524	NS	0.485	NS	*	*

Discussion:

This is the first organized evaluation concentrating on pulmonary issues after open abdominal aortic surgery and shows that PPC are frequently observed postoperative unfavorable events. Significantly, each kind of pulmonary complication is

associated to increased death of patients going through abdominal aortic surgery, both in elective and immediate surgery. Univariate analysis shows that PPC are separately related to increased perioperative death.

These outcomes matter since they must promote the identification of all the possible techniques, processes of care or preventive measures able to reduce the incidence of postoperative pulmonary problems to enhance result and survival of vascular surgery patients [(15)].

Previous literature primarily focused on the recognition of all the preoperative danger aspects for PPC with the objective to determine potentially flexible independent characteristics [(3,4,16-18)]. On the contrary, the goal of this evaluation was to obtain a more understanding of the genuine incidence of PPC after open abdominal aortic surgery and their effect on survival by methodically identifying each single pulmonary complication reported in literature.

As a matter of fact, it is surprising that up until now death and lung complications rates were not minimized over time, in spite of huge enhancements in surgical and anesthesiological techniques and management.

Regarding postoperative care, we found that extended mechanical ventilation is related to increased perioperative death. A "fast-track" technique ought to be thought about the gold standard in order to prevent the advancement of postoperative pulmonary complications [(19)].

4. STRENGTHS AND LIMITATIONS

This is the very first methodical evaluation and meta-analysis concentrating on PPC after open abdominal aortic surgery and includes all the research studies ever published on this subject.

Although we acknowledge that it is not a new details that patients having abdominal aortic surgery are at high danger for lung complications and this increases the threat of death, no studies on the real incidence of PPC after open abdominal aortic surgery and their impact on survival have actually been released up until now. We strongly think that the evidence offered by our review will cause clinicians to additional focus their attention on all the possible techniques valuable to decrease the occurrence of these serious issues, proved to seriously intensify the outcome and survival of vascular surgery patients. Furthermore, our company believes that our research study will offer a strong input to the improvement of using less intrusive surgical strategies. However our review mainly includes retrospective research studies, whose limitations are popular[(20)]. Moreover, few of the consisted of research studies focused on PPC and reported breathing complications as main outcome. In addition no "standardized" diagnosis and meanings of PPC existed in the included studies and the majority of them just reported the occurrence of" unspecified breathing complications" without any definition. Even if we excluded duplicate publications, it is possible that big, multicentric research studies might consist of data of patients previously included in little, monocentric studies.

5. CONCLUSION

Despite several studies on long-term and short outcome after open abdominal aortic surgery have been published so far, few of them focused on PPC. Moreover, most of published literature didn't concentrate on the identification and classification of PPC, since "unspecified respiratory complications" was the largest reported category, incredibly accounting for 48,412 events (22.9% of patients), while pneumonia only for 4598 events (7.6% of patients).

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