http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v8i8.38

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Assessment of Efficiency of Ariscat Score in Predicting Post-Operative Pulmonary Complications in Esophagectomy Patients at a Tertiary Cancer Care Hospital: A Retrospective Analysis

Authors

Sethu Lekshmi S[1], Rajasree Omanakutty Amma[2], Rachel Cherian Koshy[3], Praveen Rajendran[4], Soumya C.N[5], Jagathnath Krishna K M[6]

[1]Department of Anaesthesiology, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
Present Address- Senior resident, Department of Anaesthesia, Government Medical College, Thiruvanathapuram, Kerala, India
[2]Associate Professor, Department of Anaesthesiology, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
[3]Professor and Head, Department of Anaesthesiology, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
[4]Junior Resident, Department of Anaesthesiology, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
[5]Junior Resident, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
[6]Assistant Professor, Department of Epidemiology and Biostatistics, Regional Cancer Centre, Thiruvananthapuram, Kerala, India
*Corresponding Author
Rajasree Omanakutty Amma
Associate Professor, Department of Anaesthesiology, Regional Cancer Centre, Thiruvananthapuram, Kerala, India

Abstract

The study was done to assess the efficiency of Assess Respiratory Risk in Surgical Patients in Catalonia (ARISCAT) score in predicting post-operative pulmonary complications (PPC) in esophagectomy patients at a tertiary cancer care hospital by retrospective analysis. We included patients belonging to ASA II and III categories who underwent esophagectomy at our institution during June 2016 to June 2017. Patients with missing data were excluded from analysis. The medical records of these patients were reviewed to obtain data. The seven-factors of ARISCAT score were recorded from the medical records. The occurrence of post-operative pulmonary complications and length of stay were also recorded from the medical records. Statistical analysis was done using SPSS software (version 11.0). Fisher's exact test, chi-square test, Logistic regression and Kaplan-Meier analysis were used. Among the study group 16 patients out of 19 belonging to the high risk ARISCAT category (84.2%) and 8 out of 24 patients (33.3%) of intermediate risk group had PPC (P =0.002). From the logistic regression analysis there is a ten times increased risk of PPC developing in patients falling in the high-risk category of ARISCAT than those in intermediate risk category (OR=10.667, 95%CI 2.387-47.659, P= 0.002). Pre-operative SpO_2, anaemia, respiratory infection in last month and age showed a positive correlation for development of PPC in the high-risk category compared with the intermediate risk category. ARISCAT risk score has a good practical applicability in pulmonary risk stratification of esophagectomy patients and should be explored further.

Keywords: *Efficiency, Esophagectomy, Post-operative pulmonary, Retrospective Analysis, Surgical oncology, Thoracic surgery.*

Introduction

Esophageal resection and restoration of gastrointestinal continuity are technically challenging procedures. Postoperative complications affect survival rate and result in major morbidity as well as mortality with a variable occurrence of 2% to 20%[1]. Pulmonary complications are the most common postoperative

complication with 16 to 67% incidence, followed by anastomotic complications[2].

Esophageal cancer is the seventh most common cancer in men worldwide.[3] Esophagectomy by transthoracic, trans-hiatal, tri-incisional or minimally invasive approaches with or without neoadjuvant chemotherapy forms the main treatment modality[2]. Post-operative pulmonary complications (PPC) can lead to longer hospital stays, prolonged ventilation and increase the overall cost of treatment for the patient. So, focus on efforts to reduce postoperative complications, pulmonary and surgical, is necessary for improving outcomes.

Various perioperative factors determine occurrence of post-operative pulmonary complications. Prediction of risk of development of post-operative pulmonary complications pre-operatively can aid in perioperative management. ARISCAT (Assess Respiratory Risk in Surgical Patients in Catalonia) is a clinically practical seven-factor scoring system to assess risk of composite PPC for a general surgical population. This was developed by a large sample prospective, multi-center study in Spain[4]. It is approved as a standard for risk assessment by the European Society of Anesthesiologists. The scoring system utilizes the following factors- age, preoperative oxygen saturation (SpO_2), respiratory infection in previous month of surgery, preoperative anemia, surgical incision, duration of surgery and emergency nature of procedure. Based on the score patients are divided into low, intermediate and high-risk groups. The prediction of such risk with minimal variables pre-operatively is highly desirable and ARISCAT score holds good in this aspect.

Ours is a high volume center for upper gastrointestinal surgeries especially esophagectomies where risk stratification by ARISCAT scores are used and optimization strategies depending on the risk strata of patients that are vital to reduce morbidity, length of hospital stay and thereby healthcare expenses are utilized[5,6]. Even though this score was developed for European population, it is used worldwide, but literature did not yield any studies validating the score in Indian population. Hence, we decided to analyze the correlation of this risk stratification tool in predicting the postoperative pulmonary complications in our population subset.

Methods

Our aim was to assess retrospectively the correlation between ARISCAT score and post-operative pulmonary complications in patients who underwent esophagectomy for malignancy over a period of one year. We commenced the study after obtaining the Institutional Review Board clearance (IRB No: 08/2017/01 dated 29/08/2017).

We reviewed the medical records of 45 patients who underwent esophagectomy at our institution during June 2016 to June 2017. The ARISCAT scores recorded in the case sheets and postoperative pulmonary complications were analyzed. European perioperative clinical outcome (EPCO) definitions were used for defining PPC.[7] All patients who underwent esophagectomies during the above-mentioned period were included. Patients with missing data were excluded from analysis.

Statistical analysis was done using SPSS software (version 11.0). Fisher's exact test and chi-square test was used to assess association of the independent variables with ARISCAT risk. Odd's ratio and 95% confidence interval were estimated. Logistic regression was used to assess association of variables with PPC. Kaplan-Meier analysis was used to assess cumulative probability of PPC by post-operative day eight.

Observation and Results

Data from 45 patients were analyzed of which two were incomplete and hence excluded from study. Of the 43 patients remaining two patients underwent superior polar gastrectomy which was an intraoperative decision by the surgeon although they were scheduled and prepared for

esophagectomy. The distribution of type of surgery is given in table 1.

Out of the seven risk categories that are considered to calculate ARISCAT score, all patients had duration of surgery more than three hours and all were elective procedures. Five patients had respiratory infection in the previous month of surgery, six patients had low pre-operative SpO_2 and six patients had pre-operative anemia. Out of the forty-three patients analyzed, twenty-four belonged to the intermediate risk category and nineteen belonged to the high-risk category. The various risk categories are presented in table 2 and 3. Twenty-four patients (55.8%) out of the forty-three analyzed had PPC. (Table 4)

Among the 19 patients belonging to the high risk ARISCAT category, 16 (84.2%) had PPC, while eight patients out of 24 (33.3%) of intermediate risk group had PPC (P =0.002). There were total three deaths in the study population, two of them belonged to intermediate risk group and one from high risk group(P= 1.000).The PPC included an array of respiratory symptoms and signs that mandated extended postoperative intensive care stay or readmission and additional treatment. (Table 5)

Low oxygen saturation and anemia pre-operatively was found in high risk group with significant difference from intermediate risk group (P=0.072).The occurrence of respiratory infection in previous month of surgery had no significant difference between ARISCAT risk groups (P= 0.153). (Table 6)

From the logistic regression analysis there is a ten times increased risk of PPC developing in patients falling in the high-risk category of ARISCAT than those in intermediate risk category (OR=10.667, 95%CI 2.387-47.659, P= 0.002). Pre-operative SpO_2, anemia, respiratory infection in last month and age showed a positive correlation in the high-risk category and PPC compared with the intermediate risk category.

Kaplan-Meier analysis showed 54% of patients having probability of PPC by second post-operative day (figure 1). Average length of hospital stay was 12.47 days for high risk ARISCAT category whereas it was 8.87 days for the intermediate risk category.

Table 1: Distribution of type of Esophagectomy

Type of Surgery	Frequency (n)	Percentage (%)
Mckeowns	28	65.1
SPG[a]	2	4.7
THE[b]	6	14.0
TTE[c]	7	16.3
Total	43	100.0

[a]Superiorpolar gastrectomy, [b]Trans-hiatal esophagectomy, [c]Transthoracic esophagectomy

Table 2: Distribution of ARISCAT Risk Variables

ARISCAT Risk Variable		Frequency (n)	Percentage (%)
PreOP SpO2 (%)	≥96	37	86
	91-95	6	14
	≤90	0	0
PreOPanemia (≤10 gm%)		6	14
Respiratory infection in last month		5	11.6
Duration of surgery in hours	≤2	0	0
	>2 to 3	0	0
	>3	43	100
Emergency procedure		0	0
Age (yrs)	≤50	7	16.3
	51-80	36	83.7
	>80	0	0
Surgical Incision	Peripheral (neck)	34	79
	Upper Abdominal	43	100
	Intra thoracic	35	81.3

Table 3: ARISCAT Risk Category Distribution

ARISCAT Risk Category	Frequency (n)	Percentage (%)
Intermediate Risk	24	55.8
High Risk	19	44.2

Low risk < 26 points, Intermediate Risk 26-44 points, High Risk ≥45 points

Table 4: Distribution of post-operative pulmonary complications

Presence of PPC	Frequency (n)	Percentage (%)
YES	24	55.8
NO	19	44.2

Table 5: Type of post-operative pulmonary complication

	Frequency	Percent
pulmonary infection	4	9.3
pulmonary infection +respiratory failure	1	2.3
pulmonary infection + bronchospasm	2	4.7
pulmonary infection +bronchospasm +respiratory failure	2	4.7
pulmonary infection + pleural effusion + respiratory failure	1	2.3
pulmonary infection + pleural effusion +respiratory failure + pneumothorax	1	2.3
pulmonary infection + atelectasis	1	2.3
bronchospasm	1	2.3
bronchospasm+ pulmonary infection	1	2.3
pleural effusion+ pulmonary infection	2	4.7
pleural effusion + pulmonary infection+respiratory failure	2	4.7
pleural effusion+ pulmonary infection+atelectasis	1	2.3
pleural effusion +bronchospasm +atelectasis	1	2.3
atelectasis + pulmonary infection	2	4.7
atelectasis + pulmonary infection+ respiratory failure	1	2.3
atelectasis + pulmonary infection +bronchospasm	1	2.3
NA	19	44.2
Total	43	100.0

Table 6: Association of different variables, occurrence of PPC and death with different ARISCAT risk categories

Variable	Occurrence	High Risk ARISCAT category	Intermediate Risk ARISCAT category	P value
Pre-op SpO_2	Frequency (n)	5	1	0.072
	Percentage within ARISCAT category (%)	26.3	4.2	
Pre-op anemia	Frequency (n)	5	1	0.072
	Percentage within ARISCAT category (%)	26.3	4.2	
Respiratory infection during last month	Frequency (n)	4	1	0.153
	Percentage within ARISCAT category (%)	21.1	4.2	
Age (51-80 years)	Frequency (n)	17	19	0.437
	Percentage within ARISCAT category (%)	89.5	79.2	
Occurrence of PPC	Frequency (n)	16	8	0.002
	Percentage within ARISCAT category (%)	84.2	33.3	
Death	Frequency (n)	1	2	1.00
	Percentage within ARISCAT category (%)	5.3	8.3	

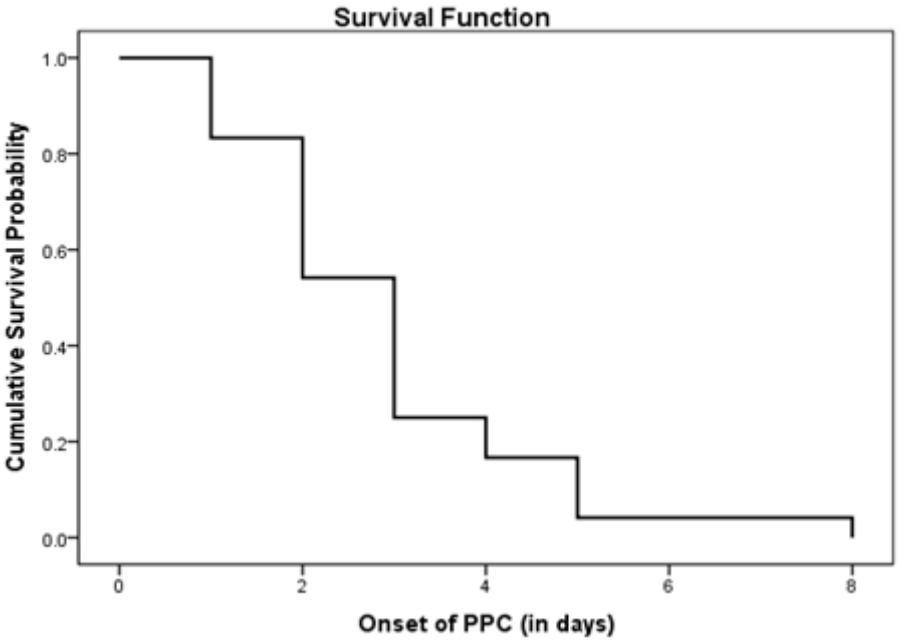

Figure 1: Kaplan Meier analysis of occurrence of PPC during post-operative period

Discussion

Postoperative pulmonary complications are a major cause of morbidity in upper gastrointestinal surgeries especially esophageal surgeries.[8] It increases length of stay after major surgeries and leads to additional financial burden. Our study evaluates the relation between ARISCAT scoring and PPC retrospectively. Though ARISCAT score is used for pre-operative respiratory risk stratification in surgical cohort of India, there are no published prospective validation studies.

In our analysis we found that there is a higher chance of PPC in the high risk ARISCAT category patients, which is statistically significant. The ARISCAT risk group classifies risk of PPC occurrence in the following order: low risk 1.6%(0.6-2.6), intermediate 13.3%(7.6- 19), high risk 42.1%(29.3-54.9).[4] In our study there was a PPC occurrence of 33.3% in intermediate risk group and 84.2% in high risk group which are higher than the predicted risk in each category. The study by Canet et al found higher risk with cardiac surgeries (39.6%) followed by thoracic (31.4%) and abdominal (7.2%)[4]. The incidence of PPC is inversely proportional to the distance of surgical incision from diaphragm and more with increasing duration.[4,9] Our overall PPC incidence was 55.8% which may be due to nature of surgery mostly involving combined thoracic and abdominal approach and longer duration of surgery.

The patient related risk factors used in ARISCAT score are pre-operative SpO2, pre-operative anemia, recent respiratory infection and age. Age and recent respiratory infection are usually significant factors for PPC occurrence[4,10]. In our groups there was no statistically significant difference between the ARISCAT risk groups regarding these two factors. Preoperative low SpO2 and anemia were significantly more in high risk group. This is in accordance with existing clinical data[11,12].

Pulmonary infection with or without respiratory failure requiring ventilator support was the highest observed pulmonary complication in post esophagectomy patients. Our analysis showed preoperative anemia, low SpO2, higher age and recent respiratory infection having a positive correlation with high risk of PPC and high ARISCAT scores. These parameters are readily available and does not require any special investigations or consultations. The most consistent among these parameters are the preoperative oxygen saturation and preoperative

anemia. Of this preoperative anemia can be corrected with our optimization strategies. Reversible causes of low saturation can also be addressed properly during the preoperative optimization. Most of the PPC occurred in the first two to three postoperative days. In our analysis we found out that by day eight the occurrence of post-operative pulmonary complications was significantly less. The significance of preoperative optimization and better patient selection is indicated by these modifiable risk factors. The requirement of intensive care especially in the first week postoperatively cannot be more stressed.

Limitations

One major limitation of our study is it being retrospective. A prospective validation of the risk score is lacking in our geographic population and is highly desired. Also, this a single center study over one-year duration. Multicenter studies involving other high-volume centers of esophagectomy and including surgical cohort of more duration can yield more generalizable results. The different surgical methods used for esophagectomies employ multiple site incisions for the same procedure. This is a limitation of employing ARISCAT score to such surgeries. Most of the cancer patients receive neo adjuvant chemotherapy as part of their treatment regimens. This has profound effects on their general health and this aspect should also be considered while evaluating such patients preoperatively. So, a score like ARISCAT applied in the general surgical population falls short in this aspect also.

Recommendations

Comparison of ARISCAT score with similar risk scores and other routinely used measures in a similar population is recommended. Development of a comprehensive scoring system addressing the shortages of existing pre-op scoring systems for onco-surgical patients is recommended. A study comparing American Society of Anesthesiologists (ASA) classification and ARISCAT risk index in renal transplant patients showed ASA classification as a weaker modality to predict pulmonary risk after renal transplantation[13]. As ARISCAT is a freely available inexpensive risk assessment tool which do not require any additional investigations other than the routine the applicability in risk assessment is high in all centers.

Conclusion

ARISCAT risk score has a good applicability in pulmonary risk stratification of esophagectomy patients and should be explored further. The incorporation of exposure to chemotherapy as well as application of multiple site surgical incisions in a high-risk surgery like esophagectomy can further increase the reliability of this preoperative pulmonary risk stratification tool.

Acknowledgements: Nil

Source of Support: No financial supports received.

Conflicts of Interest: Nil

References

1. Fisher BW, Majumdar SR, McAlister FA. Predicting pulmonary complications after nonthoracic surgery: A systematic review of blinded studies. Am J Med.2002;112(3): 219-225.
2. Schieman C, Wigle DA, C Deschamps et al. Patterns of operative mortality following esophagectomy. Diseases of esophagus.2012:25(7);645-651.
3. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians. 2018 Nov; 68(6): 394-424.
4. Canet J, Gallart L, Gomar C, Paluzie G et al. Prediction of postoperative pulmonary complications in a population-based surgical cohort. Anesthesiology 2010: 113;1338-1350.

5. Speicher P, Englum B, Ganapathi A et al. Traveling to a high-volume centre is associated with improved survival for patients with esophageal cancer. Annals of surgery. 2017:265(7); 743-749.
6. Metzger R, Bollschweiler E, Vallhohmer D et al. High-volume centres for esophagectomy: what is the number needed to achieve low postoperative mortality? Diseases of esophagus. 2004: 17(4);310-314.
7. Jammer IW, sander MN et al. Standards for definitions and use of outcome measures for clinical effectiveness research in perioperative medicine: European Perioperative Clinical Outcome (EPCO) definitions: a statement from the ESA-ESICM joint taskforce on perioperative outcome measures. Eur J Anaesthesiol 2015; 32: 88-105.
8. Complications of esophageal resection – Up To Date [Internet]. [Cited 2019 Feb 17]. Available from: https://www.uptodate.com/contents/complications-of-esophageal-resection.
9. Brooks-Brunn JA. Predictors of postoperative pulmonary complications following abdominal surgery. Chest. 1997; 111(3): 564-571.
10. Smetana GW, Lawrence VA, Cornell JE; American College of Physicians. Preoperative pulmonary risk stratification for non-cardiothoracic surgery: systematic review for the American College of Physicians. Ann Intern Med. 2006;144(8): 581-595.
11. Saager L, Turan A, Reynolds LF, Dalton JE, Mascha EJ, Kurz A. The association between preoperative anemia and 30-day mortality and morbidity in noncardiac surgical patients. Anesth Analg. 2013; 117 (4):909-915.
12. Musallam KM, Tamim HM, Richards T, et-al. Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study. Lancet. 2011;378(9800):1396-1407.
13. Kupeli E, Er Dedekarginoglu B, Ulubay G, Haberal M et al. American Society of Anesthesiologists classification versus ARISCAT risk index: Predicting pulmonary complications following renal transplant. Exp Clin Transplant. 2017; 15(1):208-213.