

Reliability Of Ariscat Score Calculator To Predict Post-Operative Pulmonary Complications After Major Hepatobiliary Surgeries

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ABSTRACT

Objective: To measure the reliability of ARISCAT (Assess Respiratory Risk in Surgical Patients in Catalonia) score calculator to predict post-operative pulmonary complications after major hepatobiliary surgeries.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Anesthesia and Intensive Care, Army Liver Transplant Unit, Pak Emirates Military Hospital (PEMH), Rawalpindi, Pakistan, from Jan to Aug 2023.

Methodology: After gaining ethics approval, ARISCAT score was calculated for 80 patients who underwent hepatobiliary surgeries for various indications with both ARISCAT score and risk index calculated in all patients with help of following parameters: pre-operative oxygen saturation, history of respiratory tract infection within last one-month, pre-operative hemoglobin concentration, type of surgical incision, duration of surgery and nature of procedure (elective or emergency). Relative risk, sensitivity and specificity were also calculated to determine reliability of ARISCAT score.

Results: There were no pulmonary complications in 4(80.00%) patients with low ARISCAT score (<26) having relative risk of 0.034 (CI 95%, 0.003-0.3440). The relative risk of development of post-operative complications was 0.429 (CI 95%, 0.127-1.44). The relative risk of development of post-operative pulmonary complication with high ARISCAT score was 8.4(CI 95%, 2.08-33.9)

Conclusion: ARISCAT score is a reliable screening tool in predicting post-operative pulmonary complications after major hepatobiliary surgery.

Keywords: abdominal surgery, ARISCAT score, hepatobiliary, quality of life

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INTRODUCTION

Post-operative pulmonary complications are a significant cause of mortality and morbidity after major surgeries and result in protracted stay at hospital.¹ They occur in 5-10% post-surgical patients in general but in patients with abdominal surgery their incidence is as high as 22% making them an important determinant of patient outcome.² General anesthesia is also a known risk factor for pulmonary complications, and the risk increases many folds in upper abdominal surgery associated with considerable blood loss.³ While pre-existing research work has outlined a number of other patient-related and peri-operative factors, which increase the incidence of post-operative pulmonary complications, most of these studies are done retrospectively and focus on one outcome only.^{4,5} while ARISCAT (Assess Respiratory Risk in Surgical

Patients in Catalonia) score has demonstrated an association between predicted frequency of pulmonary complications and actual frequency of complications, making it fairly reliable.⁶ It is derived from demographic variables.⁷ and is labeled as a risk index.⁸ Although other measures of computing post-operative risk for respiratory complications are also used like neutrophil-to-lymphocyte ratio, anemia, serum albumin levels and leukocyte count, these are not specific to pulmonary complications.⁹ ARISCAT score has also been compared with American Society of Anesthesiology (ASA) grading, however, ARISCAT score was more specific to pulmonary complications.¹⁰ The objective of this study was to use ARISCAT score in a prospective manner to assess the predictability of post-operative pulmonary complications among patients as, if found reliable, this score could help in pre-operative risk assessment, devising peri-operative and prophylactic management strategies, counseling and post-operative rehabilitation of patients in our resource-constrained setting.

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METHODOLOGY

This quasi-experimental study was conducted at Department of Anesthesia and Intensive Care, Army Liver Transplant Unit, Pak Emirates Military Hospital (PEMH), Rawalpindi, Pakistan, from Jan to Aug 2023. The permission of Ethics Committee of hospital was obtained with IERB number A/28/EC/519/23. Sample size was calculated using World Health Organization (WHO) sample size calculator with expected sensitivity of ARISCAT score to be 100%¹¹ and expected specificity to be 90.5%¹¹, expected prevalence of pulmonary complications after upper abdominal surgeries to be 24%, confidence level of 95% and desired precision of 0.06. The sample was calculated to 68 patients, but we included 80 patients in the study using non-probability consecutive sampling.

Inclusion Criteria: Patients aged between 20 to 65 years, with Body Mass Index (BMI) between 18-30 kg/m² and admitted for elective and emergency major hepatobiliary surgeries such as Whipples' procedures, right or left hepatectomies, non-anatomical liver resections, bile duct clearance and repair surgeries, gallbladder bed resections, hepaticojejunostomy, triple bypass procedures, liver transplants, Frey's procedures, pancreatojejunostomy, de-roofing with pericystectomy of hydatid cysts or cysto-gastrostomies.

Exclusion Criteria: Patients with known pulmonary pathology such as asthma, Chronic Obstructive Pulmonary Disease (COPD), bronchiectasis, restrictive lung disease, pre-operative pleural effusion, pneumonia or history of pulmonary tuberculosis.

Pre-anesthesia assessment was done, and ASA status was recorded. The primary outcome was post-operative pulmonary complications including pleural effusions, pneumonias, atelectasis, pulmonary embolism, re-intubations and mechanical ventilation. The ARISCAT score and risk index was calculated in all patients using pre-operative oxygen saturation, history of respiratory tract infection within last one-month, pre-operative hemoglobin concentration, type of surgical incision, duration of surgery and nature of procedure (elective or emergency). The occurrence of post-operative pulmonary complications after major surgeries using the ARISCAT score are low if the score is < 26, intermediate if the score is 26 - 44 and high if the score is > 45, with 76 being the maximum possible ARISCAT score.¹² After surgery the patients were extubated and transferred to Intensive Care Unit for

post-operative care and observed for pulmonary complication for the next 4 days. Demographic and clinical details, including age, weight and duration of surgery were also recorded. All collected data was analyzed using Statistical Package Of Social Science version 23.0. The categorical data was analyzed using frequency and percentages and the quantitative data was analyzed using means and standard deviation while relative risk was calculated to find reliability of ARISCAT score by cross-tabulation. The study protocol is presented in Figure-1.

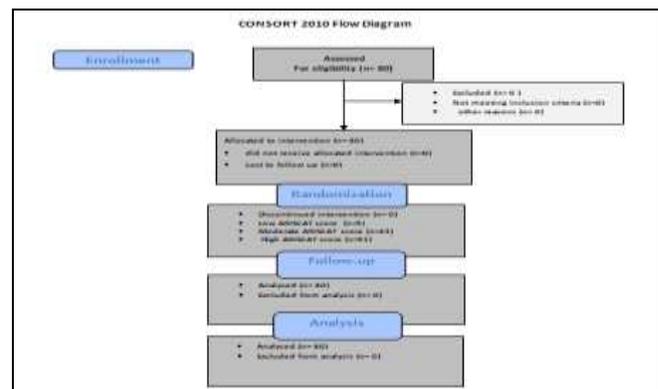


Figure-1: Consort 2010 Flow Diagram

RESULTS

A total of 80 patients became a part of our study (n=80) where mean age was 53.79±8.94 years and mean weight was 69.85±5.619kgs, while 59(73.80%) were males and 21(26.30%) were females. The mean duration of surgery was 5.51±1.18 hours with 14(17.50%) patients being ASA-I, 13(16.35%) patients being ASA-II, and 53(66.30%) patients being ASA-III. The most prevalent surgeries were non-anatomic liver resection of liver and bile duct clearance with repair which were performed in 14(17.50%) patients. The most common co-morbid condition was diabetes mellitus 10(12.00%). Detailed demographic and clinical findings are shown in Table-I.

There were no pulmonary complications seen in 4(80.00%) patients with low (<26) ARISCAT score with relative risk of 0.034 (CI 95%, 0.003-.340), 13(52.40%) patients with moderate ARISCAT score (26-45) developed pleural effusion, while 4(16.70%) developed pneumonia and 1(4.20%) developed atelectasis, relative risk of development of post-operative complications was 0.429 (CI 95%, 0.127-1.44). A total 51 patients had high ARISCAT scores (> 45) and 2(3.95%) of them developed pleural effusion while 5(9.80%) had to be placed on mechanical ventilation

making the relative risk of development of post-operative pulmonary complication 8.4(CI 95%, 2.08-33.9) as shown in Table-II.

The sensitivity and specificity of ARISCAT score in predicting post-operative pulmonary complications is also shown in Table-III.

Table-I: Demographic and Clinical Characteristics of Participants (n=80)

Variable	Mean±SD	
Age (Years)	53.79±8.94	
Weight (Kilograms)	69.85±5.62	
Duration of Surgery (Hours)	5.51 ±1.18	
	n (%)	
Gender	Male	59(73.80)
	Female	21(26.30)
ASA Status	I	14(17.50)
	II	13(16.30)
	III	53(66.30)
Type of Surgery	Whipple’s	3(3.80)
	Cysto-gastrostomies	2(2.50)
	Hepatectomy	10(12.50)
	Non-anatomic Liver Resection	14(17.50)
	Bile Duct Clearance and Repair	14(17.50)
	Gall-bladder Bed Resection	12(15.00)
	Hepaticojejunostomies	10(12.50)
	Frey’s Procedure	4(5.00)
	Pancreatojejunostomies	6(7.50)
	De-roofing + Per-cystectomies of Hydatid Cyst	5(6.30)
Co-morbidities	Diabetes Mellitus (DM)	10(12.00)
	Hypertension (HTN)	8(10.00)

Table-II: Association of ARISCAT Score with Frequency of Pulmonary Complications (n=80)

	ARISCAT <26 (n=51) n (%)	ARISCAT:26-45 (n=24) n (%)	ARISCAT >45 (n=5) n (%)
Pleural Effusion	0(0.00)	13(54.20)	33(64.70)
Pneumonia	0(0.00)	4(16.70)	6(11.80)
Atelectasis	0(0.00)	1(4.20)	2(3.90)
Mechanical Ventilation	0(0.00)	2(8.30)	5(9.80)
Re-intubation	1(20.00)	0(0.00)	2(3.90)
No Pulmonary Complication	4(80.00)	6(25.00)	3(5.90)

DISCUSSION

The ARISCAT score has been in use by clinicians around the world.¹² but in Pakistan it has not gained attention. According to evidence in literature,

ARISCAT score proved to be an appropriate screening tool for prediction of pulmonary complications in patients undergoing cardiac surgery.^{13,14} as patients in cardiac surgery are more prone to pulmonary complications due to bypass related problems. Another study demonstrated that 30% of their patients developed pulmonary complications after abdominal surgery, noting that ARISCAT score is a promising screening tool which can help in peri-operative management of patients who are considered high risk.¹⁵ The patients in our study also had considerably high frequency of pleural effusion in post-operative period as the development of pleural effusion after abdominal surgeries is linked to disruption of peritoneal diaphragm and transudation of fluid from abdomen across peritoneal diaphragm¹⁶ which can complicate post-operative recovery and adequate interventions like non-invasive ventilation and drainage can help limit further consequences. Another study.¹⁷ noted that surgeries on geriatric patients resulted in high incidence of pulmonary complications as they were more prone to adverse respiratory outcomes. A randomized control trial.¹⁸ conducted to predict the validation of ARISCAT score found that it has good prognostic value as patients who had higher score had ten times higher risk of development of post-operative pulmonary complications, resulting in a fair utility in predicting the risk of complications, which helped clinicians in pre-operative preparation, risk stratification and counseling of patients and attendants. We utilized this score in a subset of patients who underwent abdominal surgeries and it proved reliable. Patients who were operated on under regional and neuroaxial anesthesia also developed some post-operative pulmonary complications¹⁹ however, in our study, patients only received general anesthesia.

LIMITATIONS OF STUDY

This study has several limitations. Its quasi-experimental design and relatively small sample size of 80 patients from a single, specialized liver transplant unit limit the generalizability of the findings to other healthcare settings or broader patient populations undergoing hepatobiliary surgery. The short study duration and the lack of long-term follow-up mean that pulmonary complications occurring beyond the immediate perioperative period may not have been captured. Furthermore, the absence of a comparative control group and the wide confidence intervals observed for some relative risk calculations suggest some statistical imprecision, warranting cautious interpretation of the predictive reliability.

Table-III: Specificity, Sensitivity of ARISCAT score and Relative Risk with respect to Pulmonary Complications (n=80)

ARISCAT Score		Pulmonary Complications
Low	Sensitivity	80.00%
	Specificity	100.00%
	Positive Predictive Value	30.80%
	Negative Predictive Value	6.30%
Moderate	Sensitivity	75.00%
	Specificity	46.20%
	Positive Predictive Value	26.90%
	Negative Predictive Value	46.20%
High	Sensitivity	100.00%
	Specificity	63.70%
	Positive Predictive Value	71.60%
	Negative Predictive Value	23.10%

CONCLUSION

ARISCAT score is a reliable screening tool in predicting post-operative pulmonary complications after major hepatobiliary surgeries.

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Authors’ Contribution

Following authors have made substantial contributions to the manuscript as under:

SAMR & AR: Data acquisition, data analysis, critical review, approval of the final version to be published.

KM & MSK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

NMW & AYZ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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