

Implementation of PENN Arthroplasty Risk Score (PARS) as Predictors of the Need for Critical Care After Total Joint Arthroplasty in Sanglah General Hospital

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ABSTRACT

Background: The purpose of this study was to know the implementation of Penn arthroplasty risk score (PARS) as predictors of the need for critical care after total joint arthroplasty in Sanglah General Hospital.

Methods: Fifty-five patients who undergoing total hip replacement and total knee replacement at our institution between September 2019 and August 2020 are included to this study. The condition of patient pre and post operatively is calculated with PARS score. The PARS score of all patient then matches with decision of anaesthesiologist whether the patient is admitted to the intensive care unit post operatively or not.

Results: In total of 55 patients undergoing total joint arthroplasty, there were 10 (18.2%) patients admitted to intensive care unit and 45 (81.8 %) patients admitted to ward postoperatively. Based on PARS score, there were 9 patients undergoing total joint arthroplasty who had score ≥ 3 of PARS score and all of those patients were matched with anaesthesiologist decision of administration of intensive care post operatively.

Conclusion: The present study concluded that PARS score could be one of predictors of the need for critical care after total joint arthroplasty. A

larger prospective study or may be a multicentre trial can further improve the interpretation of the results.

Keywords: PARS score, intensive care, total joint arthroplasty, THR, TKR

INTRODUCTION

The number of total joint arthroplasties (TJA) performed continues to rise, and due to the progress in modern medicine, older patients with more medical comorbidities are now among those undergoing TJA. Despite TJA being widely regarded as a safe, successful surgery with excellent patient outcomes, complications can occur. Additionally, surgeons and hospitals are increasingly focused on optimizing perioperative care following TJA given the rise in value-based payment strategies, which include episode of care and bundled payment models. Alternative payment models aim to provide quality care in a cost-efficient manner by homing in on hospital length of stay (LOS), discharge disposition, and readmission rates.^[1-4]

With the number of total joint arthroplasties projected to reach 4 million annually by 2030, hospitals can be expected to allocate an increasing amount of critical care services to orthopaedic patients. Estimated hospital costs associated with total joint arthroplasty (TJA) reached \$30 billion in 2004 and are expected to continue to increase. Although TJA is widely regarded as a successful surgery with excellent patient outcomes, complications including pulmonary embolism, acute renal failure, tachyarrhythmia, and myocardial infarction can occur.^[5-8]

In 2014, Courtney et al has developed risk score for predictors of the need for critical care after total joint arthroplasty. That score has 5 factors which predicted a requirement of intensive care following TJA included 1) intraoperative vasopressor requirements; 2) EBL >1000 ml; 3) COPD; 4) CHF; and 5) CAD. Based off of the regression coefficients, intraoperative variables (EBL > 1000 ml and intraoperative vasopressor requirements) were weighted more than preoperative variables by approximately a factor of 2. Based on this model, Courtney et al (2014) developed the Penn Arthroplasty Risk Score (PARS) as a practical way to determine which patients are at risk for needing critical care intervention. Patients with a score of 0 have a baseline probability of requiring critical care intervention of 7.0%, those with a score of 1 through 7 have a probability of 13.2%, 23.5%, 38.1%, 55.4%, 71.4%, 83.4%, and 91.1% respectively. The authors have proposed a PARS cutoff of 3 points and higher for triage to the intensive care unit postoperatively. would decrease the amount of ICU admissions to 120 (7.5%) from the current 295 (19%).^[1]

Therefore, the aim of this study is to know the implementation of Penn arthroplasty risk score (PARS) as predictors of the need for critical care after total joint arthroplasty in Sanglah general hospital so as to reduce the need for postoperative intensive care in

patients with the TJA procedure. With reduced intensive care in patients with the TJA procedure, it is hoped that it will reduce patient care costs and will increase the allocation of intensive care to other patients who really need it.

METHODS

We conducted a descriptive retrospective study, using patients' medical record data obtained from Sanglah General Hospital between September 2019 – August 2020, with a total of 55 patients undergoing total hip replacement (THR) and total knee replacement (TKR). The variables obtained were age, sex, diagnosis, treatment, PARS score, ASA and post-op care.

RESULT

During the 12 months study period, 55 patients undergoing total joint arthroplasty (THR and TKR). Among those patients, 10 patients were male (18%) and 45 patients were female (82%). 22 (40%) patients aged <60 years old and 33 (60%) patients aged >60 years old. Characteristic condition of the patient assessed with ASA by anaesthesiologist, 4 (7%) patients with ASA I, 19 (35%) patients with ASA II, 32 (58%) patients with ASA III.

For treatment characteristic, 9 (16%) patients undergoing THR for total joint arthroplasty and 46 (84%) patients undergoing TKR. There are variety of diagnosis included to this study, that is 6 (12%) patients of avascular necrosis of femur head, 1 (2%) patients of malignant bone tumour, 2 (4%) patients of fracture proximal femur, 28 (51%) patients of bilateral osteoarthritis of knee Kellgren and Lawrence type IV and 17 (31%) patients of unilateral osteoarthritis of knee Kellgren and Lawrence type IV.

Peen arthroplasty risk score (PARS) characteristic obtained in this study is only score 0 until 5 and there is no score 6 and 7 obtained in this study. 11 (20%) patients has

score 0, 21 (38%) patients has score 1, 14 (25%) patients has score 2, 5 (10%) patients has score 3, 3 (5%) patients has score 4 and 1 (2%) patient has score 5. 10 patients undergoing THR and TKR were admitted in intensive care unit and 45 patients were admitted to ward. Decision of anaesthesiologist of intensive care administration and PARS score was then has been matched. 54 decisions of anaesthesiologist were matched with PARS score of the patient while other 1 patients were mismatched with PARS score of the patients.

DISCUSSION

During the 12 months study period, 55 patients undergoing total joint arthroplasty (THR and TKR). Among those patients, female patients were dominant compare to male patient. This could happen because female sex is significant risk factor for osteoarthritis and a study found that women tended to have higher rates of progression and worsening of radiographic knee osteoarthritis in all age groups.^[9] This study found that patient aged >60 years old were dominant compare to patient aged <60 years old. This finding match with recent study that elderly patient was significant risk factor for osteoarthritis. Characteristic of ASA of the patient perioperatively were dominant in ASA III with hypertension, diabetes mellitus type II and geriatric are mayor comorbid.^[10]

In this study we found variety of diagnosis of patient undergoing total joint arthroplasty with TKR procedure was dominant compare to THR procedure. In the patient undergoing THR, the most common diagnosis is avascular necrosis of the femur. While in the patient undergoing TKR, the most common diagnosis is bilateral osteoarthritis of knee Kellgren and Lawrence type IV. Those two diagnoses are indication for patient undergoing total joint arthroplasty.^[11]

Peen arthroplasty risk score (PARS) characteristic obtained in this study is only score 0 until 5 and there is no score 6 and 7 obtained in this study. Majority patients in this study has score 1 and only 9 patients have score ≥ 3 that have indication to admitted to intensive care based on PARS score. All of the patients with PARS score ≥ 3 were admitted to intensive care based on anaesthesiologist postoperatively after total joint arthroplasty procedure. This finding could be used as a basis for further research with a larger sample so as to obtain more valid data. With this data, it is hoped that it can help determine the administration of postoperative patients for total joint arthroplasty whether it requires intensive care or not. In addition, these findings provide a reference for the anesthesiologist in determining the postoperative admission of patients undergoing total joint arthroplasty where the factors included in the PARS score can be used as an important reference for further patient care. So that it will open up opportunities for the treatment of other patients who have more absolute indications for intensive care.

Decision of anaesthesiologist of intensive care administration and PARS score was then has been matched. 54 decisions of anaesthesiologist were matched with PARS score of the patient while other 1 patient were mismatched with PARS score of the patients. In the patient that has mismatched PARS score with decision of anaesthesiologist is caused by the decision of anaesthesiologist that admitted patient to intensive care while the PARS score of the patients indicated forward admission. This can be because the PARS score only focuses on the factors that affect the total joint arthroplasty, while the determination of the anesthesiologist is thorough looking at all aspects of the patient from previous history, physical examination and laboratory examinations of patients, pre and postoperatively.

Table 1 Characteristic of PARS score in Patient Undergoing Total Joint Arthroplasty

Diagnosis	Treatment	Sex	Age	Risk Factors					Orthopaedic Assessment		Anesthesiology Assessment		Match/ Mismatch
				COPD	CHF	CAD	EBL >1000	Intraoperative Vasopressors	PARS	Post-Op Care	ASA	Post-Op Care	
OA Right Hip Ec AVN Right Head Femur	THR	F	48	N	N	N	N	2	2	Room	I	Room	Match
OA Left Hip Ec AVN Left Head Femur	THR	M	64	N	N	N	N	N	0	Room	II (Mild Renal Impairment)	Room	Match
AVN Hip Bilateral Ficat Arlet IV	THR	F	59	N	N	1	N	2	3	ICU	III (Mild Renal Impairment + Hypokalemia)	ICU	Match
Secondary Malignant Bone Tumor Left Acetabulum	THR	F	54	1	N	N	2	N	5	ICU	II (History of Chemotherapy)	ICU	Match
AVN Left Hip Ec Post Traumatic Osteoarthritis	THR	F	18	N	N	N	2	N	2	Room	I	Room	Match
AVN Left Hip Ficat And Arlet Stage IV	THR	M	54	N	1	N	2	N	3	ICU	III (HT Gr II Controlled)	ICU	Match
Avn Left Head Femur Ficat And Arlet Stage Iv	THR	M	52	N	1	N	N	N	1	Room	II (Uncontrolled Hypertension)	Room	Match
Cf Right Intertrochanter Femur	THR	F	50	N	N	N	N	2	2	Room	I	Room	Match
Post Right THR With Losing Femoral Stem	Revision THR	M	77	N	N	N	N	2	2	Room	II (Geriatric)	Room	Match
Bilateral OA Knee KL IV	TKR	F	56	N	N	N	N	2	2	Room	III (HHD ec HT Stg II)	Room	Match
Bilateral OA Knee KL IV	TKR	M	52	N	1	N	N	2	3	ICU	III (HT St II, Mild Renal Insufficiency, DM Type II)	ICU	Match
OA Right Knee KellgNen Lawrence IV	TKR	F	58	1	1	1	N	N	3	ICU	III (CHF FC II, CAD, HHD)	ICU	Match
OA Left Knee KL III	TKR	F	66	N	1	N	N	N	1	Room	III (Geriatric, HT Type II Controlled, Cardiomegaly)	Room	Match
OA Right Knee KL IV	TKR	M	68	1	N	N	N	N	1	Room	III (History Of TB Infection With Sequele, Moderate Renal Impairment)	Room	Match
OA Right Knee KL IV	TKR	F	59	N	N	N	N	N	0	Room	III (Geriatry, Hypertension Gr II Controlled)	Room	Match
Bilateral OA Knee KL IV	TKR	F	58	N	N	N	N	N	0	Room	II (Obesitas)	Room	Match
OA Left Knee KL IV	TKR	F	55	N	N	N	N	N	0	Room	II (Obesitas)	Room	Match
OA Knee Bilateral	TKR	F	80	N	1	N	N	N	1	Room	III (Octogenitarian, CHF	Room	Match

Ketut Kris Adi Marta et.al. Implementation of penn arthroplasty risk score (pars) as predictors of the need for critical care after total joint arthroplasty in Sanglah General Hospital

											FC II, HT Terkontrol (Captopril, Bisoprolol, Simvastatin)	m	
OA Knee Bilateral	TKR	F	69	N	1	N	N	N	1	Room	III (HHD Ec HT Stg I)	Room	Match
OA Knee Billateral KL IV	TKR	F	73	N	1	1	N	2	4	ICU	III (Geriatry, HHD , HT Gr I , RBBB, Renal Mild Impairment)	ICU	Match
OA Knee Billateral KL IV	TKR	F	58	N	1	N	N	N	1	Room	III (Uncontrolled Hypertension)	Room	Match
OA Knee Billateral KL IV	TKR	F	61	N	1	N	N	N	1	Room	II (Controlled Hypertension)	Room	Match
OA Knee Billateral KL IV	TKR	F	73	N	N	N	N	2	2	Room	II (Controlled Hypertension and Obesity)	Room	Match
OA Left Knee KL IV	TKR	F	54	1	1	N	N	N	2	Room	III (Controlled Hypertension and DM Type II)	Room	Match
OA Right Knee KL IV	TKR	F	60	N	1	N	N	N	1	Room	II (Cardiomegaly)	Room	Match
Periprosthetic Joint Infection Left Knee Post Debridement + Spacer	TKR	F	67	1	N	N	N	N	1	Room	III (Geriatry, Obesitas)	Room	Match
OA Knee Billateral KL IV	TKR	F	70	N	1	1	N	N	2	Room	III (Geriatry, HT Stage II Controlled, CAD)	Room	Match
OA Knee Billateral KL IV	TKR	F	63	N	1	N	N	N	1	Room	III (Uncontrolled Hypertension)	Room	Match
OA Knee Billateral KL IV	TKR	F	69	N	N	N	N	N	0	Room	III (Geriatry)	Room	Match
OA Knee Billateral KL IV	TKR	F	68	N	1	1	N	N	2	Room	III (Geriatry, Cardiomegaly, Mild Anemia)	Room	Match
OA Knee Billateral KL IV	TKR	F	67	N	1	N	N	N	1	Room	II (HHD, Cardiomegaly)	Room	Match
OA Right Knee KL IV	TKR	F	68	N	1	N	N	N	1	Room	III (Geriatry, Cardiomegaly)	Room	Match
OA Knee Billateral KL IV	TKR	F	70	1	1	N	N	N	2	Room	III (HHD FC Class 2)	Room	Match
OA Knee Billateral KL IV	TKR	F	58	N	1	N	N	N	1	Room	II (HT Gr II)	Room	Match
OA Left Knee KL IV	TKR	F	45	N	N	N	N	N	0	Room	II (Mild Anemia)	Room	Match
OA Knee Billateral KL IV	TKR	F	68	N	1	1	N	N	2	Room	II (Geriatry, Cardiomegaly, HT Gr I)	Room	Match
OA Knee Billateral KL IV	TKR	F	71	N	1	N	N	N	1	Room	III (Geriatry and HHD)	Room	Match
OA Knee Billateral KL IV	TKR	F	49	N	N	N	N	N	0	Room	II (HT Gr II)	Room	Match

Ketut Kris Adi Marta et.al. Implementation of penn arthroplasty risk score (pars) as predictors of the need for critical care after total joint arthroplasty in Sanglah General Hospital

OA Left Knee KL IV	TKR	F	64	N	1	N	N	2	3	ICU	II (Geriatry, Anemia and Moderate Renal Insufiency)	m	ICU	Match
OA Knee Billateral KL IV	TKR	F	68	N	N	N	N	N	0	Room	II (Geriatry And Obesitas)	Room	Room	Match
OA Left Knee KL IV	TKR	F	53	N	1	1	N	N	2	Room	II (HHD, Cardiomegaly)	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	71	N	1	N	N	N	1	Room	III (Cardiomegaly, Controlled Hypertension)	Room	Room	Match
OA Right Knee KL IV	TKR	F	41	N	N	N	N	N	0	Room	I	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	64	1	1	N	N	N	2	Room	II (Asma and Cardiomegaly)	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	73	N	1	N	N	N	1	Room	III (Uncontrolled Hypertension)	Room	Room	Match
OA Left Knee KL IV	TKR	M	52	N	1	1	N	2	4	ICU	III (Uncontrolled DM Type II, Hypertension Gr II, Renal Insuficiency)	ICU	ICU	Match
OA Knee Billateral KL IV	TKR	F	61	N	N	N	N	N	0	Room	III (Mild Renal Impairment + Moderate Anemia)	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	66	N	1	N	N	N	1	Room	III (Geriatry, Hypertension Gr II Uncontrolled)	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	57	N	N	N	N	N	0	Room	III (Controlled Hypertension and Obesity Gr II)	Room	Room	Match
OA Knee Billateral KL IV	TKR	M	62	N	1	N	N	N	1	Room	III (DM Type II, Hypertension and Obesity)	Room	Room	Match
OA Knee Billateral KL IV	TKR	F	66	N	1	1	N	2	4	ICU	III (Geriatry, Hypertension, Obesity, Cardiomegaly)	ICU	ICU	Match
OA Left Knee KL IV	TKR	M	74	N	1	N	N	N	1	Room	III (Geriatry, HT Gr II, Hyperglycemic Susp Metabolic Syndrome)	ICU	ICU	Mismatch
OA Right Knee KL IV	TKR	F	65	N	1	N	N	N	1	Room	III (HT Gr II And HHD)	Room	Room	Match
OA Left Knee KL IV	TKR	F	70	N	1	1	N	N	2	Room	IIII (Cardiomegaly, HHD and Hypertension Gr I)	Room	Room	Match
OA Left Knee KL IV	TKR	M	64	N	1	N	N	N	1	Room	III (Geriatry, HT Gr II and DM Type II)	Room	Room	Match

CONCLUSION

This case series found favourable implementation of Penn arthroplasty risk score (PARS) as predictors of the need for critical care after total joint arthroplasty in Sanglah General Hospital. PARS score could be one of predictors of the need for critical care after total joint arthroplasty. A larger prospective study or may be a multicentre trial can further improve the interpretation of the results.

Declaration by Authors

Ethical Approval: This research received approval from the Department of Orthopaedic and Traumatology Udayana University on 24 June 2019 with ethical clearance number (No 142/EC/KEPK.RSUP.DISKES/2023)

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Attachement

PARS Score

Peen Arthroplasty Risk Score	Score
Chronic Obstructive Pulmonary Disease	1
Congestive Heart Failure	1
Coronary Artery Disease	1
EBL N ≥1000	2
Intraoperative Vasopressors	2
Total	7

Mismatch Result

Diagnosis	Orthopaedic Assessment		Anesthesiology Assessment		Treatment in Intensive Care
	PARS	Post-Op Care	ASA	Post-Op Care	
OA Left Knee KL IV	1	Room	III	ICU	Vital sign observation, transfusion of PRC, observation of hyperglycemic state ec susp metabolic syndrome
