Successful Enhanced Recovery After Surgery (ERAS) for Total Knee Arthroplasty: is Patient Selection Really Necessary?

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INTRODUCTION:

Total knee arthroplasty (TKA) is an effective treatment for end-stage osteoarthritis of the knee. With an increasingly aging population, the number of patients requiring TKA is expected to rise. Two of the most effective ways to reduce healthcare cost associated with TKA are to shorten the length of hospital stay and minimize postoperative complications. In recent years, there has been increasing interest in Enhanced Recovery After Surgery (ERAS) for TKA patients. In order for ERAS TKA to be safe and efficacious, careful patient selection has been advocated. In this study, the authors seek to explore the commonly used selection criteria for ERAS TKA to assess their influence on successful completion of ERAS protocol and post-operative complications.

METHODS:

All patients who were eligible for ERAS TKA and underwent unilateral TKA from August 2020 to July 2021 were prospectively followed up. The inclusion criteria were: 1) Unilateral TKA; 2) ASA ≤ 3; 3) Patient agreeable for discharge to home. ERAS TKA was done as day surgery, with patients discharging within 23 hours after surgery. The ERAS TKA protocol also comprised of: 1) review by physiotherapist for ambulation on same day after surgery; 2) home visit by physiotherapist at POD 1 week; and 3) home visit by nurse at POD 2 weeks. All patients were reviewed at 30-days postoperation and complications such as readmission to hospital, infection, and reoperation were recorded. Patient characteristics such as age, gender, Charlson's Comorbidity Index (CCI), American Society of Anaesthesiologists (ASA) classification, and Body Mass Index (BMI) were compared between patients who passed ERAS TKA protocol and those who failed, as well as between those with and without postoperative complications. Binary logistic regression model was constructed to ascertain the effect of patient characteristics on passing ERAS TKA protocol and complication rate.

RESULTS:

A total of 342 patients who underwent ERAS TKA during the study period were included. The mean duration taken from the end of surgery to review by a physiotherapist and ambulating >10meter was 11.8 (±0.8) hours. In total, 315 patients (92.1%) successfully completed the ERAS TKA protocol and were discharged within 23hrs. Of the 27 (7.9%) patients who failed ERAS TKA protocol, the most common reason was inadequately controlled pain (17.9%), patient decision to transfer to step-down facility (17.9%), postoperative nausea and vomiting (7.1%), and acute urinary retention (7.1%). Thirteen out of the 27 patients who failed ERAS protocol were discharged on POD2, and only 8 patients had an inpatient stay of more than 3 days. There was no statistically significant difference in age, gender, CCI, ASA classification, side of surgery, and BMI between patients who passed protocol and those who failed (Table 1).

The 30-days readmission rate was 2.6% (9 patients). There were 5 cases of infection (1.5%), with 2 prosthetic joint infection (PJI) (0.6%) requiring debridement, antibiotics, and implant retention (DAIR), 2 surgical site infection treated with antibiotics, and 1 pneumonia. Three patients (0.9%) underwent reoperation within 30 days, consisting of the 2 DAIR and 1 patient who underwent joint aspiration that was negative for PJI. The only difference between patients who had complications were male gender as all 3 cases of reoperation occurred in males (Table 2).

A binary logistic regression model was constructed to ascertain the effect of age, gender, CCI, ASA class, and BMI on the likelihood that patient will: 1) Pass or fail ERAS protocol; 2) 30-days readmission; 3) 30-days infections; 4) 30-days reoperation. The logistic regression model was statistically insignificant for all 4 end points (Passing or failing ERAS protocol ($x^2(5) = 4.837$, $p = 0.436$), 30-days readmission ($x^2(5) = 5.757$, $p = 0.331$), 30-days infection ($x^2(5) = 6.344$, $p = 0.274$), and 30 days reoperation ($x^2(5) = 8.998$, $p = 0.109$)). None of independent variables contributed significantly to the model (Table 3).

DISCUSSION AND CONCLUSION:

The most important finding in this study was that no significant predictor of failure of ERAS protocol or increased postoperative complications were noted. In order for ERAS TKR to be safe and cost-effective, careful patient selection has been advocated. However, this may exclude many potential patients who will benefit from this protocol. As this was a pilot study of ERAS TKA, the positive finding from this study will serve to justify its application to a wider range of patients undergoing TKA. By broadening the inclusion criteria for ERAS TKA, more patients can potentially benefit from this safe and cost-effective protocol.

Table 1. ERAS TKA Protocol Passes and Failures

	Pass ERAS (n = 315)	Failed ERAS (n = 27)	p-value
Mean age, yrs (SD)	67.5 (7.0)	65.6 (7.8)	0.191†
Male:female gender, n	112:203	11:16	0.590‡
Mean CCI (SD)	2.6 (1.1)	2.3 (1.1)	0.316§
ASA grade >2, n	25	4	0.218‡
Side of surgery, left:right	142:173	11:16	0.663‡
Body Mass Index, kg/m² (SD)	27.7 (4.7)	27.6 (5.2)	0.921§

*Statistically significant
†Student's unpaired t-test
‡Chi-squared test
§Mann–Whitney U test

Table 2. 30-days readmission, infection, and re-operation

	Re-admission (n = 9)	No re-admission (n = 333)	p-value	Infection (n = 5)	No infection (n = 337)	p-value	Re-operation (n = 3)	No re-operation (n = 339)	p-value
Mean age, yrs (SD)	67.2 (8.3)	67.3 (7.1)	0.945	64.4 (8.5)	67.4 (7.0)	0.350	68.9 (2.3)	67.3 (7.1)	0.694
Male:female gender, n	6:3	117:216	0.052	4:1	119:218	0.039*	3:0	120:219	0.020*
Mean CCI (SD)	2.6 (1.6)	2.6 (1.1)	0.929	2.0 (1.0)	2.6 (1.1)	0.228	2.3 (0.6)	2.6 (1.1)	0.687
ASA grade >2, n	0	29	0.355	0	5	0.493	0	29	0.596
Side of surgery, left:right	3:6	150:183	0.486	2:3	151:186	0.830	1:2	152:187	0.690
Body Mass Index, kg/m² (SD)	27.9 (5.0)	27.7 (4.8)	0.864	27.8 (2.4)	27.7 (4.8)	0.953	27.5 (2.8)	27.7 (4.8)	0.961

*Statistically significant
†Student's unpaired t-test
‡Chi-squared test
§Mann–Whitney U test

Table 3. Binary logistic regression on effect of age, gender, CCI, ASA class, BMI

	Est (B)	95% CI	p-value
Pass/Fail ERAS protocol			
Age	0	1 to 1	0.955
Gender	0	0 to 2	0.872
CCI	0	0 to 1	0.267
ASA	-1	0 to 1	0.102
BMI	0	1 to 1	0.517
30-days Readmission			
Age	0	1 to 1	0.985
Gender	-1	0 to 1	0.0584
CCI	0	0 to 2	0.825
ASA	-18	0 to 0	0.998
BMI	0	1 to 1	0.620
30-days Infection			
Age	0	1 to 1	0.781
Gender	-2	0 to 1	0.074
CCI	1	0 to 14	0.486
ASA	-17	0 to 0	0.998
BMI	0	1 to 1	0.877
30-days Re-operation			
Age	0	1 to 1	0.222
Gender	-18	0 to 0	0.995
CCI	2	0 to 220	0.292
ASA	-16	0 to 0	0.998
BMI	0	1 to 1	0.601

*Binary logistic regression using Omnibus Tests of Model Coefficients
†Statistically significant
Est.B, estimate beta coefficient; CI, confidence interval