

The Implementation of Fast-Track Surgery on Patients Undergoing Prosthetic Knee Replacement Surgery in the University Hospital “Federico II”



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Abstract

Introduction: The focus of the present study is on the introduction of Fast track surgery in the Complex Operative Unit (COU) of Orthopaedics and Traumatology of the University Hospital ‘Federico II’. It allows the improvement of quality in prosthetic knee replacement surgery.

Methods: In the case study there are two groups of patients undergoing prosthetic knee replacement surgery, they were treated at the COU of Orthopaedics and Traumatology of the University Hospital ‘Federico II’. Statistical analyses were conducted on these groups.

Results: The following project considered more variables that can influence the length of hospital stay for inpatient treatment, increasing the patients’ management costs due to longer hospitalization. Therefore, appropriate corrective actions were identified and implemented. The average length of hospital stay was reduced from 8.34 to 6.68 (-19.9%).

Conclusion: In agreement with national and international literature but leaving out the analysis of patients’ outcome, this paper demonstrates that Fast Track surgery can improve quality of the orthopaedics surgical process and reduce both length of hospital stay and, consequently, costs.

Keywords: Public Health; Health Care; Clinical Guidelines; Evidence Based Medicine; Traumatology; Orthopedics; Hospitalization; Morbidity; Mortality; Haemostasis; Gastrointestinal; Thromboembolism; Anti-Inflammatory; Physiotherapy; Demographic

Abbreviations: LOS: length of Hospital Stay; NSAIDs: Non-Steroidal Anti-Inflammatory Drugs; LMWH: Low Molecular Weight Heparin; ASA: Anesthesiologists

Introduction

Fast Track surgery is based on the idea that the perioperative phase is an area of interest for all the specialties. Its aim is the decreasing of stress response of the patient to the surgery [1]. The direction of the Department of Public Health of the University Hospital ‘Federico II’ decided to adopt a new clinical pathway for patients undergoing prosthetic knee replacement surgery. The protocol introduced different actions whose aims were the reduction of morbidity, mortality and functional recovery with an earlier achievement of functional milestones with subsequent reduced LOS and high satisfaction [2]. It is based on patients’ preoperative optimisation, pain and haemostasis control [3-5]. It proved to be useful both to improve patients’ outcome and to reduce costs acting on the perioperative phase. As a result, it was applied in various contexts such as gastrointestinal, colonic and orthopaedic

surgeries but also in cholecystectomy and prostatectomy [6-10]. Paper’s focus was on the management area (specifically in costs and length of hospital stay (LOS)) because it would have been the main theme of the case study. So, just like other previous studies [11-12], we analysed all patients that underwent Fast Track surgery in the COU of Orthopaedics and Traumatology of ‘Federico II’.

Materials and Methods

The protocol consists in the education of patients, in a multimodal approach to get both pain and hemostasis (bleeding/thromboembolism) control. Studies of Turpie, Mantovani and Kreutz [13-15] showed that its control with pharmaceutical agents is useful because thromboembolism is a frequent complication in orthopaedic surgery. It included the use of local (3 grams /50ml saline solution) tranexamic acid associated with local

wound infiltration with naropin 2mg/ml to get to pain relief and local bleeding control. Non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol were commonly given in association for multimodal analgesia. For thromboprophylaxis, low-molecular-weight heparin (LMWH) was administered for all patients once a day until 30 days after surgery. Postoperatively, there was the start of physiotherapy within the first 24 h and it was repeated with active exercises twice a day until discharge. Physiotherapy aims to quickly recover movement of the joint, to strengthen the muscles and to gain a normal gait pattern. The discharge criteria were both medical and functional [16]: the patient had to walk 30 meters with crutches, to climb stairs, both to dress and to go to the toilet independently. Pain relief, stable medical conditions and no wound problems have also to be reached for hospital discharge.

To check the validity of the new clinical pathway, information was collected on two samples of patients operated for 24 months. We considered 44 patients in the year before the protocol (January 2016 - December 2016), 58 patients in the year following the introduction of fast track surgery (January 2017 - December 2017), yet we excluded from the study of the second year 8 outliers because of death or post-operative complications. We collected data from both printed medical records and digital information system database of the University Hospital 'Federico II' because not every information is stored in the electronic system; there was the possibility of finding comorbidities (for example diabetes and cardiovascular disease) only on the papery medical records. Then, the analysis was performed using Matlab 2017, Excel 2016 and test calculators (GraphPad, Social Science Statistics). Mean LOS was 8.34 before the start of our new protocol and the standard deviation was 2.41. Figure 1 how's a run chart before the introduction of the clinical pathway. We applied a test of normality, Jarque-Bera test with a significance level α of 0.05 [17,18], to test the normality of the sampling distribution. Following the methodology presented in two previous works [19-20], through a reunion that involved all

the clinical staff, we found the source of the longer LOS in our case study. 13 potential causes were identified and divided as follows: four major causes (patient, health care staff, system, process), and some new secondary causes (pain and bleeding related to patients; delay in health recovery related to health care staff).

Results

The average LOS was reduced from 8.34 to 6.68 days and standard deviation was reduced from 2.41 to 1.99 days with a reduction of -19.9% and -17.4% respectively on the mean and on the standard deviation. In Table 1, it is possible to find the complete statistical analyses observing the clear differences in LOS before and after protocol's implementation and a demographic study on the considered independent variables (chi square test was applied with an $\alpha=0.05$ to all the subgroups). It was also verified that patients' sampling were normal distributions (p-value of 0.846). The variables significantly influencing the LOS were: age, presence of cardiovascular disease and American Society of Anesthesiologists (ASA) score. After a thorough investigation on patients' medical records, we supposed that these factors had been influential: patients with allergies need a medical therapy before the surgery; the presence of diabetes, cardiovascular diseases and the ASA score represent patient's state of health and they can influence the onset of post-operative complications. The comparative statistical analyses revealed a high significant decrease in LOS after the implementation of the improvement action. The most significant reduction was found for patients without cardiovascular diseases (-27.2%). However, similar results have been observed for patients with a high ASA score, with diabetes and without allergies (about -20%). Concerning the demographic study, no statistically significant difference between sub-groups was observed. In Figure 2 there is a run chart after the introduction of Fast Track surgery, the comparison with Figure 1 gives evidence of a clear decrease of LOS.

Table 1: Difference in LOS related to variables.

Variable	Categories	LOS Before Protocol (Mean \pm Std Dev)	LOS After Protocol (Mean \pm Std Dev)	Difference	P-Value T-Test	Before Protocol Frequencies	After Protocol Frequencies	P-Value Chi-Square Test
All patients		8.34 \pm 2.41	6.68 \pm 1.99	-19.9%	<0.0001			
Gender	Male	7.15 \pm 1.41	7.43 \pm 2.51	+3.9%	0.6176	14	12	0.3978
	Female	8.78 \pm 2.40	6.56 \pm 1.92	-25.3%	<0.0001	30	38	
Age	<60	8.35 \pm 2.48	6.00 \pm 2.45	-28.1%	0.0192	6	7	0.9356
	60<Age<75	7.98 \pm 2.01	6.93 \pm 1.84	-13.2%	0.0234	26	31	
	>75	9.07 \pm 2.41	6.42 \pm 2.19	-29.2%	0.0067	12	12	
Allergies	Yes	8.15 \pm 2.25	6.75 \pm 1.49	-17.2%	0.0127	16	20	0.7174
	No	8.63 \pm 2.18	6.90 \pm 2.31	-20.0%	0.0004	28	30	
Cardiovascular disease	Yes	8.35 \pm 2.48	7.65 \pm 1.90	-8.4%	0.2077	23	25	0.9138
	No	8.28 \pm 2.13	6.03 \pm 1.83	-27.2%	<0.0001	22	25	

Diabetes	Yes	9.35 ± 2.69	7.50±2.17	-19.8%	0.1127	9	6	0.2640
	No	8.15± 2.31	6.81±1.97	-16.4%	0.0011	35	44	
ASA score	I-II	8.42 ± 2.08	6.87±1.74	-18.4%	<0.0001	32	40	0.4060
	III-IV	8.23 ± 2.76	6.70±2.79	-18.6%	0.1212	12	10	

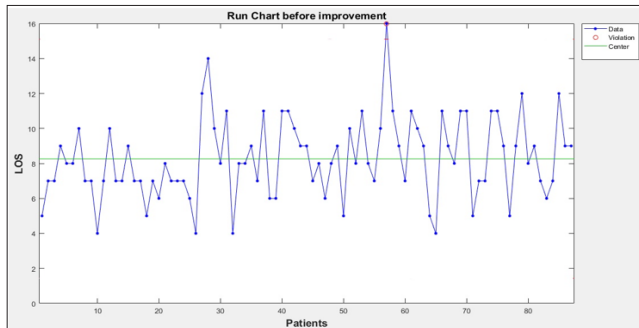


Figure 1: Run Chart Before improvement.

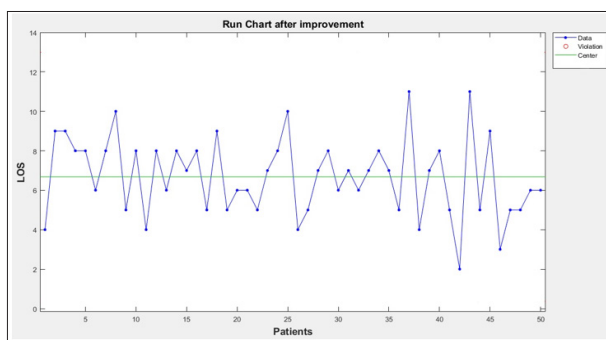


Figure 2: Run Chart After improvement.

Discussion and Conclusion

Just like other orthopaedic studies, even in the University Hospital 'Federico II' the implementation of Fast Track brought good results. The advantages of this new process were for both patients and hospitals. In this study, the corrective actions started from the optimisation of the patient for the surgery and got to the postoperative phase while in other older works [19-20] there was the optimisation of the entire preoperative phase (introducing the pre-hospitalization). Patient satisfaction and outcomes were not monitored; nevertheless, the significant reduction in LOS, an increase in admissions and in beds available surely had a positive influence on patient outcomes. Through the application of the corrective actions, there has been a significant reduction and a lower variability of LOS. Moreover, considering the average cost of 1 day of hospital stay at the national level [21], the implementation of our project let the hospital save about 50000 euro. There are some limitations in this study. The sample size was not so big; the study was conducted in the specific context of the Italian University Medical Center with the possibility of an influence on the results. The general application of standardized procedures and management strategies could become promising tools to increase the quality of many health care organizations and helpful means of eliminating waste and improving operational efficiencies and

overall value to patients [22-24]. Using Fast Track surgery in our process, the results of the analysed variable (LOS) were similar to the ones of other works such as Wang et al. [25] and Keulemans et al. [9]. The difference with these other studies is the absence of focus on patients' outcome (we did not monitor the functional test of Barthel, MRC and VAS like Castorina et al. [26]; so it could be interesting as a future development the study of morbidity, mortality and functional convalescence for patients who went through this new fast track surgery. Our case study could be assessed with a managerial tool, DMAIC cycle. In the literature it is possible to find other works that used this methodology [27-29].

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