



The Role of Clinical Pathways on Healthcare Quality Improvement in Hospitals for Patient Undergoing Total Hip Replacement

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Abstract

Background: Clinical pathways are important tools to achieve better quality of care and to reduce the costs for healthcare system. The total hip replacement (THR) is among the most expensive procedures in health system and the number of these operations has greatly increased in the past decade in the Republic of Srpska.

Aim: The aim of the present study was to determine how the implementation of a clinical pathway for THR can influence the length of stay and postoperative complications in hospitals in the Republic of Srpska.

Methods: This prospective and comparative study was performed on 2,485 patients who underwent the THR over a 3-year-period in 2012 (prior to the introduction of the clinical pathways, baseline), in 2013 (first evaluation period) and in 2014 (second evaluation period), one and two years after its implementation, respectively. The study was conducted in 10 hospitals in the Republic of Srpska, where the effects of the clinical pathways on length of stay and postoperative complications after THR were measured.

Results: The introduction of THR clinical pathways significantly decreased the length of stay in hospital from 14.53 ± 7.03 days measured at baseline, to 12.79 ± 4.81 days and 11.19 ± 4.11 days at first and second evaluation period, respectively. At the same time, the number of early postoperative complications such as death and venous thromboembolism significantly decreased in both groups, while the number of dislocations, as parameter of late complications, decreased just after the second evaluation period. For all other complications, such as revision procedures, infections and periprosthetic fracture, there were no statistical differences after the implementation of clinical pathways.

Conclusion: The introduction of clinical pathways was successful in reducing the length of stay in hospitals as well as the postoperative complications after THR.

Key words: clinical pathways, total hip replacement, length of stay, quality of care.

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Introduction

Total hip replacement (THR) is an orthopaedic surgery performed to reduce pain and improve function in patients suffering from hip fractures or hip arthritis. In recent decades, there has been a growing need for this procedure, which is the result of an aging of population, an increase in the prevalence of osteoarthritis and the presence of

obesity epidemic.¹ If this trend continues in the future, an even greater increase in the need for intervention such as THR can be expected.²

Although the THR is a cost-effective treatment, both from the clinical and patients' perspective, this operation produces a significant cost for hos-

pitals, which could be a critical issue due to limited funds available for healthcare systems. Having that in mind, it would be extremely important to introduce certain instruments for costs control without compromising the quality of patient care. There are several strategies that are being applied for quality of care improvement in hospitals, but introduction of clinical pathways, also known as care pathways (CP), have been seen as the most successful instrument for quality of care improvement and reduction of costs in healthcare worldwide.^{3,4} There is a considerable amount of evidence that implementation of CP can reduce both the length of stay in hospital and cost of treatment, without undesirable outcomes and postoperative complications.⁵⁻⁹ However, these studies have never been performed in health system of the Republic of Srpska.

Vanchaecht et al¹⁰ studied the effects of CPs on total knee arthroplasty in a large teaching hospital in Belgium and concluded that CPs effectively reduce the length of stay (LOS) by 33 % without affecting the short-term functional outcomes. Results of studies conducted in hospitals in the Netherlands showed that using a CP approach for patients with hip fracture tends to be more effective than usual care.¹¹ In another study conducted in 11 US hospitals, it was demonstrated that the implementation of THR clinical pathway was successful in reducing the patient's LOS in hospital, as well as with increasing discharges to home what consequently led to cost reduction.¹²

The aim of this study was to determine how the implementation of a CP for THR can influence the LOS and postoperative complications in hospitals in the Republic of Srpska, Bosnia and Herzegovina.

Methods

Study period

This prospective and comparative study was performed in all patients who underwent the THR over a 3-year period. This period covered the 12 months (January – December 2012) prior to the introduction of the CPs, and the 24 months follow-up period (January 2013 - December 2013 and January 2014 -December 2014) after its implementation.

Development and implementation of the clinical pathways

The CPs were developed by a multidisciplinary team of healthcare professionals involved in the THR patients care in accordance with recommendations of international clinical guidelines. The team was comprised of an orthopaedic surgeon, a clinical quality coordinator, a chief nurse and a physiotherapist. The objectives of this CP were the reduction of LOS in hospital and the reduction in post-operative complications. In this regard, the following key interventions and outcomes were defined: (1) admission criteria; (2) admission date; (3) prophylactic use of antibiotics; (4) thromboembolic prophylaxis; (5) start of physiotherapy procedure on postoperative day 1; (6) discharge criteria and (7) discharge date. The structure and the identification of other activities in the process (nursing assessment, evaluation by a physiotherapist, daily monitoring, etc) in addition to responsibility for these activities were left to each hospital to be adapted according to organisational and working conditions.

Sample size

The study was conducted in 10 hospitals in the Republic of Srpska, at the departments for orthopaedic surgery that regularly perform THR procedure. The clinical pathway project began in January 2013. Each patient underwent the THR gave the informed consent to participate in the study. Before the implementation of the CP, a baseline measurement was performed from January 2012 to December 2012 in one group of patients (n = 849; 288 men and 561 women). First evaluation of the CP was done from January 2013 to December 2013 in a second group of patients (n = 802; 284 men and 518 women). Second evaluation was done from January 2014 to December 2014 in a third group of patients (n = 834; 262 men and 572 women). Therefore, the total number of patients included in this study was 2,485. Patients excluded from this study were those with THR revision (replacement of previously fitted prosthesis), as well as the patients suffering from cancer as a primary diagnosis.

Indicators

To measure the effects of CPs the two groups of indicators were defined, known as the process and the outcome indicators. The process indicator was measured by the average LOS in hospital, while the outcome indicators were measured through early complications, as a rate of various surgical complications within 90 days (venous thromboembolism, death) and late complica-

tions, as the outcomes within one year after surgery (infection, dislocation, periprosthetic fracture, revision of surgery).¹³

Measurements were taken at three time points: the baseline measurement, the second measurement taken 12 months after the implementation of the pathway and the third measurement taken 24 months after the implementation of the pathway. The outcomes were registered during the hospital stay and throughout the follow-up period. For all three groups of patients the follow-up period was 1 year after surgery.

Data collection and monitoring

Data collection and monitoring were carried out continuously, by entering data into the on-line application form for routine monitoring of quality indicators designed by the Agency for Certification, Accreditation and Healthcare Quality Improvement of the Republic of Srpska (ASKVA). The electronic system for collection, monitoring, analysis and presentation of quality indicators results in hospitals of the Republic of Srpska has been successfully introduced at the beginning of 2011 as an online application. The responsible hospital staff enters the required information from CP for all patients no later than on the fifth day of each month for the previous month. The reliability of data was adequate since data were used to categorise patients according to the Diagnosis Related Group system (DRG) and the consequent payment of each hospital by the Health Insurance Fund.

Statistical analyses

Data analysis were performed using the commercial statistical software SPSS Statistics 18. Verification of the normality of parameters distribution was performed using the Kolmogorov-Smirnov test. Statistical significance between groups was verified using the Kruskal-Wallis test and the post hoc comparison by using the Mann-Whitney test. Individual variables were presented in the form of frequency of individual characteristics (categories) and the statistical significance of the differences is determined using the chi-square test. The significance level was set at $p < 0.05$.¹⁴

Results

The study included a total of 2,485 patients with performed THR. The first group, before the CP

was implemented, included 849 patients with a mean age of 70. The second group of 802 patients, with an average age of 68, underwent the primary THR based on CP and was assessed during the first evaluation period. Eight hundred thirty-four patients, with a mean age of 68, had THR surgery based on CP and was assessed during second evaluation period. All three groups were similar regarding the age and gender (Table 1).

Average length of stay

The implementation of THR pathway corresponded with the decreased LOS in hospitals by 22.9 % during the overall observational period (first group compared to second evaluation group; $p < 0.001$). Compared to the years of observation (2012-2013 and 2012-2014), the average length of stay decreased by each year (12.79 and 11.19 days, respectively; Table 1).

Table 1: Demographics and clinical data regarding years of observation

Parameters	Baseline evaluation (n = 849)	First evaluation group (n = 802)	Second evaluation group (n = 834)
Age	70.69 ± 23.69	67.92 ± 25.11	68.60 ± 23.64
Gender, n (%)			
female	561 (66.08)	518 (64.59)	572 (68.59)
male	288 (33.92)	284 (35.41)	262 (31.41)
Average length of stay	14.53 ± 7.03	12.79 ± 4.81*	11.19 ± 4.11*

All data (except gender) are presented as mean value ± SD. * $p < 0.001$

The differences between the average LOS were significant in both evaluation periods. The average LOS was significantly decreased in both observational periods; 2012 to 2013 ($p < 0.001$), as well as 2012 to 2014 ($p < 0.001$) (Table 2).

Table 2: Paired statistical comparison of average length of stay data according to the evaluation period

Evaluation period	z value	p value
First evaluation (2012 vs 2013)	6.04	$p < 0.001$
Second evaluation (2012 vs 2014)	13.57	$p < 0.001$

Postoperative complications

The implementation of CPs significantly reduced the total number of postoperative complications in the second and third group of patients; from 134 at baseline (first group) to 92 (second group) and 79 (third group) measured at the first and second evaluation period, respectively. In the first group, 15.9 % of patients had at least one postoperative

Table 3: The rates of postoperative complications after THR

A. Postoperative complications		Baseline (2012) n = 849		First evaluation (2013) n = 802		χ^2	p-value
	n	%	n	%			
Early complications							
Death	57	6.71	32	3.99	5.999	0.014 *	
Venous thromboembolism	28	3.30	12	1.50	5.663	0.017 *	
Late complications							
Revision procedures	15	1.77	24	2.99	2.687	0.101	
Infections	9	1.06	9	1.12	0.015	0.903	
Dislocation	13	1.53	4	0.50	3.360	0.067	
Periprosthetic fracture	13	1.53	11	1.37	0.073	0.786	
Total of complications	135	15.9	92	11.47	6.456	0.011	
B. Postoperative complications		Baseline (2012) n = 849		First evaluation (2014) n = 834		χ^2	p-value
	n	%	n	%			
Early complications							
Death	57	6.71	27	3.24	10.722	0.001 ***	
Venous thromboembolism	28	3.30	11	1.32	7.280	0.006 **	
Late complications							
Revision procedures	15	1.77	21	2.52	1.134	0.286	
Infections	9	1.06	5	0.60	1.082	0.298	
Dislocation	13	1.53	2	0.24	7.943	0.004 *	
Periprosthetic fracture	13	1.53	13	1.56	0.002	0.963	
Total of complications	135	15.9	79	9.47	15.092	0.001	

THR – total hip replacement; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

complication and the most frequent one within 90 days after surgery was death, which occurred in 57 of all cases (6.71 %). During the first evaluation period, 11.47 % of patients in second group had at least one of postoperative complications and the most common one within 90 days after surgery in this period was also death (32 cases; 3.99 %). At the second evaluation period complications were observed in 9.47 % of patients in the third group and the most common one within 90 days after surgery was again death, but that number was significantly lower than in the previous two groups (27 cases; 3.24 %). The incidence of other postoperative complications observed in all three groups are presented in Table 3.

For each of the early observed complications there were comparative differences in terms of their reduction, from baseline to the first year of observation, but the statistically significant differences were present only for two major complications such as death and venous thromboembolism ($p < 0.05$). However, comparing the impact of CPs on post-operative complications after two years of its implementation, the difference was even more significant, particularly in complications such as: death ($p < 0.001$), venous thromboembolism ($p < 0.01$) and dislocation ($p < 0.05$), (Table 3).

Concerning the late postoperative complications there was no significant improvement after the first and second evaluation periods, although the number of revision procedures even increased, but not significantly (Table 3).

Discussion

The present study evaluated the role of CPs on quality of care for patients undergoing the THR surgical procedure. The implementation of CPs significantly decreased the LOS by 22.9 %. Although the LOS in this study has been decreased, it is still longer than in other hospitals as it was confirmed in similar studies, mainly from USA and Europe.^{5, 7, 10, 11, 15} It is well known that CPs contribute to reducing the LOS in general, the same result in terms of the existence of a positive relationship between CPs and reduced hospital stay was also observed for patients with THR surgery.⁴ ⁵ Beside the improvement of process indicators, the reduced number of postoperative complications is the most important finding of this study confirming that the full implementation of the CPs significantly improved the healthcare quality in the hospital settings. Postoperative physical rehabilitation is a very important component in

the postoperative recovery of patients after THR. The CP in this study includes early rehabilitation which also contributes to faster discharge from the hospital, followed by a process of further rehabilitation at a rehabilitation hospital or at a community-based rehabilitation (CBR) centre. Timely discharge from the hospital and subsequent referral to rehabilitation centres is another value of clinical pathways because they represent a good logistical support throughout the process.

Indicators of treatment outcomes were significantly improved after the introduction of CPs. Most importantly, the mortality significantly decreased from 6.71 % at the baseline evaluation to 3.24 % at the second evaluation. Similarly, the frequency of another two important postoperative complications, venous thromboembolism and dislocation, also decreased due to the implementation of CPs. However, this positive effect can simultaneously lead to some negative effects such as long-term complications. The ultimate goal of CPs is to optimise the quality and certainly not only to decrease the length of stay. For example, Mauheran et al. found that implementation of a CPs decreased the length of hospital stay, but at the same time it increased the rate of dislocations following THR surgery, underscoring the need to consider the long-term effects of CPs.¹⁶

A systematic review done by Mufarrih et al showed that there is a positive effect of hospital volume on outcomes following THR, that is, "high-volume" hospitals had superior outcomes compared with "low-volume" hospitals (LOS, early and late postoperative complications).¹⁷ Establishing a system for measurement and monitoring the process of providing health care, as well as the system for their improvement and in accordance with the defined Deming principles of quality, it is possible to achieve improvements in the "low volume" hospitals. In other words, implementing the CPs taken from the experiences of "high volume" hospitals can realise the benefit for the wider population of patients.¹⁸ This study showed that the implementation of CPs can reduce the unwanted deviations and process variations for complex interventions such as THR allowing "low-volume" hospitals to achieve better quality of care and help "high-volume" hospitals to improve their quality.

The present study has some limitations. First, the patient sample is large enough, but the baseline measurement occurred a year before the CPs were

implemented. Therefore, it cannot be excluded that some of the observed improvements represent a natural drift toward higher performance. A different study design, such as a randomised controlled trial, could improve the strength of these findings. Another limitation of the study is the lack of measurement of patient satisfaction. The combination of outcome indicators with patient satisfaction could provide more accurate information about the quality of care which is achieved by implementing CPs.

In addition, the introduction of CPs does not necessarily have a positive effect on all patient-related outcomes. In contrast, cost-effectiveness from the point of view of health care providers may even be extremely reduced, as indicated by the research of Krummenauer et al¹⁹ and Cochrane systematic review and meta-analysis by Rotter et al.⁵ This study did not include the cost implications of the implementation of CPs, which would certainly be desirable for future research in the field of clinical pathways.

Conclusion

The introduction of CPs in hospitals in the Republic of Srpska significantly reduced the LOS in hospital and also reduced the postoperative complications in patients after THR. Significant improvements in different groups of patients suggest that the implementation of the CPs does have an impact on the quality of care.

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Conflict of interest

None.

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