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Critical Pathway for Patients Undergoing Aortic-Surgery: Impact on Postoperative Care at an Intensive Care Unit in Sweden

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Short title

Critical Pathway for Aortic-Surgery patients

Declarations

Conflict of interest: None

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Abstract

Background: In January 2007, the intensive care unit (ICU) at a Swedish hospital introduced a critical pathway for patients undergoing aortic-surgery. The aim of this study is to evaluate the impact of this initiative, with regard to postoperative care in an ICU.

Method: A comparison of two patient groups - 17 patients treated one year before and 20 patients treated one year after the introduction of the pathway was performed, and considered gastrointestinal tube, intake of clear fluids, intake of nutrition drink or meal, breathing exercise and mobilization.

Results: No statistically significant differences in mean age, gender, anaesthetic risk factors, preoperative bleeding, length of surgery and length of mechanic ventilation between the groups existed. The patients in the pathway group had their gastrointestinal tube removed significantly earlier ($p<0.05$) and received intake of clear fluids and nutrition drink or meal significantly ($p<0.05$) earlier than patients in the control group.

Conclusion: Critical pathway for patients undergoing aortic-surgery has a positive impact on postoperative care. Aortic-surgery patients treated in accordance with the pathway at the ICU received nursing interventions earlier than patients who were treated without pathway, which is crucial for the quality of care and optimal outcome.

Keywords: Critical pathway, nursing, intensive care, postoperative, aortic aneurysm.

Introduction

Critical pathways are a guide or a pre-adopted intervention plan designed to standardize and improve patient care among a specific patient population by promoting continuity and scheduled treatment as well as evaluation and evidence-based care.¹⁻³ The implementation of critical pathways has increased worldwide in recent years and in most countries pathways have been developed mainly to achieve improvements in the quality of care.^{1,4-6} Critical pathways have been developed for practically all surgical procedures including aortic surgery. However, critical pathway is a new concept in Sweden and still at a developmental stage.

Although several definitions of critical pathway exist, for example the European Pathway Association uses the definition “care pathways are a methodology for the mutual decision making and organization of care for a well-defined group of patients during a well-defined period”² and previous studies found that the benefits of a critical pathway are several^{3,5,7-14} an accepted definition of critical pathway does not exist in Sweden, and no recommendations have been drawn up to address how pathways should be developed. However, critical pathway as a tool has gained recognition in Sweden in recent years. A national survey carried out by the National Board of Health and Welfare to investigate the quality and the extent to which critical pathways are used at hospitals in Sweden, emphasized the importance of developing critical pathways that are based on evidence and are written for multi-professional use. It further emphasized the importance of initiating national-level cooperation to develop critical pathways for certain groups of patients suffering from specific diseases or undergoing the same treatment.¹⁵ Further, the National Board of Health and Welfare concluded in a case report that critical pathways for postoperative care promote patient safety.¹⁶ The effect of critical pathways seems to be most pronounced for complex treatments.³ Patients who have undergone aortic-surgery are in great need of high quality care, with early postoperative treatments for an optimal outcome and early recovery.¹⁷⁻²⁰

The need for systematic evaluations of pathways has been cited^{6,21-22} by organisations such as the Swedish Society of Nursing²³ the European Pathway Association,² and the Cochrane Collaboration.²⁴ No published Swedish study on the introduction of critical pathway for patients undergoing aortic-surgery has been found. Therefore, the aim of the present study is

to evaluate the impact of a critical pathway for patients undergoing aortic-surgery, with regard to the postoperative care in an Intensive Care Unit.

Method

Study design

This study was conducted at one ICU in Sweden. The study was carried out using an investigation of patients who were treated before and after the introduction of a critical pathway for patients undergoing aortic-surgery. A retrospective review of the electronic medical and nursing records and the paper-based anaesthetic and survey records was conducted and a comparison of the two groups was performed.

Patient population

The study population consisted of all patients that underwent elective aortic aneurysm surgery at the hospital during one year before and one year after the introduction of the critical pathway.

Study endpoints

The background of the study population was collected with regards to patient characteristics, including: gender, age and anaesthetic risk factors according to the American Society of Anaesthesiologists [ASA].²⁵ Perioperative factors which could have a possible effect on the patients' postoperative care were also collected, including: perioperative bleeding, length of surgery and length of mechanic ventilation.

The impact of the pathway was evaluated by selecting five nursing interventions: breathing exercises, removal of nasogastric tube, consumption of clear fluid drinks, intake of nutrition-drink or meal and mobilization. The variables were selected from the aspect that the nursing interventions would be evidence-based, measurable in time and available in the patient record. Data were collected on when interventions were carried out. The time from extubation until performed intervention was calculated. The time was consistently rounded up to the quarter-hour.

Sample size

The study was carried out using an investigation of the total population of patients that underwent elective aortic aneurysm surgery at the hospital during the time of the study. Between August 2005 and July 2006, before the introduction of the pathway, all 21 patients that had undergone elective aortic aneurysm surgery were identified. Of these, four patients were excluded, two because of an adverse course of care, one because of confidentiality issues, and one because medical and anaesthetic records were not available. Consequently 17 patients who were treated before the introduction of the pathway were included in the study as a control-group.

From January to December 2007, 20 patients underwent elective aortic aneurysm surgery at the hospital. These patients were all treated according to the pathway and were included in the study, and are referred to as the pathway group.

Intervention

The critical pathway for patients undergoing aortic-surgery has been in use at the ICU at the current hospital since January 2007. The pathway was developed by a multidisciplinary team consisting of nurses, surgeons, anaesthesiologists, nurses aides and physical therapists at the Department for Anaesthesiology. A thorough literature review was first performed to identify the latest treatment standards and the best current practices for postoperative care for aortic-surgery. Second, a retrospective review of medical records for patients who had undergone aortic-surgery during 2004-2005 was carried out. The developed pathway describes the sequence of events that should occur on each of the days from patient admission to the ICU to discharge from the ICU, and authorizes nurses to perform interventions without medical prescriptions from a physician. Prior to the implementation of the pathway there was no standardized postoperative instruction for aortic aneurysm surgery patients at the ICU and a medical prescription was required prior to nursing intervention for all patients.

Statistical Analyses

All statistical analysis was performed with SPSS (Statistical Package of Social Science), version 16.0. Continuous data were analyzed with the 'Student's t-test for equality of means' and categorical data were analyzed with 'Pearson Chi-Square tests'. A p-value of <0.05 was considered significant.

Results

Characteristics of the sample

Altogether, 37 patients who underwent elective aortic-surgery were included in the study, 20 patients treated with a pathway and 17 patients treated without a pathway. The mean age (SD) of the patients in the pathway group at the time for aortic-surgery was 68 (± 9.2) years, ranging from 54 to 84 years. Corresponding ages for the control group were 73 (± 6.6) years, ranging from 60 to 85 years. No significant differences in age or gender between the groups were observed ($p > 0.05$). Among the patients, 76% ($n=13$) were men in the pathway group and 65% ($n=13$) were men in the control group.

No significant differences were found between the pathway and control groups with regard to anaesthetic risk factors according to ASA.²⁵ Fifty five percent of the patients in the pathway group were classified as being in risk groups 1-2 compared to 65 % of the patients in the control group. Corresponding numbers for risk groups 3-4 were 45 % and 35 % respectively. The patient peroperative bleeding, length of surgery and length of mechanic ventilation were similar in the control and pathway groups (Table 1).

The impact of the critical pathway on postoperative care

The time from extubation until performed nursing intervention is presented in Figure 1. The nasogastric tube was removed 9.97 hours (62%) earlier in the pathway group than in the control group ($p < 0.05$). Patients in the pathway group had their nasogastric tube removed after 6.1 hours compared to 16.07 hours for the patients in the control group. Patients in the pathway group received clear fluid intake 6.79 hours earlier than patients in the control group (8.56 vs. 15.35) ($p < 0.05$).

An earlier intake of nutrition-drink or meal by 8.45 hours (39%) was observed in the pathway group compared to the control group; patients in the control group received nutrition-drink or meal after 21.53 hours, compared with after 13.11 hours ($p < 0.05$) in the pathway group. No significant improvement in nursing intervention for breathing exercises and mobilization was observed between the groups. (Table 2).

Discussion

In the present study, we found that a critical pathway for patients undergoing aortic-surgery has a positive impact on given care, evidenced by nursing interventions being preformed earlier for patients who were treated according to the pathway than for patients that were treated without pathway. Early nursing interventions are crucial for good quality care¹⁷⁻²⁰ and since the pathway gives the nurses authorisation to perform intervention without medical prescriptions from physicians they can thereby promote and assure a positive outcome for the patient.

The greatest time improvement was found in removal of the nasogastric tube; the pathway group had their nasogastric tube removed 9.97 hours or 62% earlier than patients treated before the introduction of the pathway. The pathway gives instructions to remove the nasogastric tube when the nurse determines that the risks of aspiration no longer exist. Before the pathway was introduced, and even if patients expressed discomfort, the nasogastric tube was retained until medical prescription was given to remove it. Consequently patients often had to keep the nasogastric tube until the day after the operation, when the surgeon made his or her round. The pathway supports good treatment outcomes since less time with nasogastric tube is essential for reducing the risk of postoperative ileus and pulmonary complications.²⁶⁻²⁸

The standardized instruction in the pathway also resulted in that the pathway group received intake of clear fluid drinks 6.79 hours and nutrition-drink or meal 8.45 hours earlier than the patients treated without pathway. There is no indication that transferring the right to make decisions concerning oral intake from the doctor to the nurse through standardized instruction jeopardizes the patients' care since Ng and Niell²⁹ emphasize that early oral intake, together with mobilisation, is crucial to reducing postoperative ileus and time of hospital stay.

The elapsed time between extubation and mobilization out of bed was improved after the introduction of the pathway, but not significantly so. Although no significant effects were observed, we did observe that following the introduction of the pathway, the nurse's were more aware of mobilization, patients were mobilized more frequently, which is crucial to prevent postoperative complications.²⁹ Even if further research is needed, we believe in the

use of pathway as a structured tool to remind nurses about the importance of mobilization. The pathway promotes patient safety, and patients with seemingly equal needs receive equal care independent of who among the staff is working. Before the pathway was introduced, no instructions existed regarding at what time to mobilize aortic-surgery patients. It is likely that the nursing mobilization decisions were based on personal experience rather than on actual evidence-based standards or that some nurses experienced an uncertainty as to whether mobilization was allowed from the surgical point of view. Today, the pathway includes clear instructions that state that mobilization should be carried out the same day as the surgery is performed, as soon the patient's condition allows this. However, the time when mobilization is performed depends on the time of day the surgery is performed. Mobilization is not performed during the night, and patients who had surgery late in the afternoon were not in a condition to be mobilized during the evening on the day of surgery, resulting in mobilization being delayed until the next day.

With respect to time between extubation and mobilization, no statistically significant level was observed for the time elapsed between extubation and the initiation of breathing exercises. However, the patients in the pathway group started breathing exercises after 3.35 hours compared to 6.70 hours for the patients in the control group. From a patient perspective, the reduction of 3.35 hours is important since early breathing exercises reduces the risk of postoperative pulmonary complications for patients undergoing surgery.^{27, 30}

In accordance with other investigators³ we have addressed the benefits of the use of critical pathways for treating high risk patients at an ICU where extensive resources are available. However, even if the staff at the ICU appears to have accepted the critical pathway, understands its content and correctly applies it, there is a need for continuous evaluation and structured efforts to ensure that the staff remains acquainted with the critical pathway. We believe the pathway promotes patient safety, and patients with seemingly equal needs, receive equal care independent of who among the staff is working.

The present study has limitations to consider. All data were collected from medical and nursing records. The use of patient-records as a data source is fraught with potential sources of error. Interventions can be performed without being documented, the documentation may be inaccurate or the time of the interventions may be documented much later than the actual time at which the intervention was made. However, we considered the risk of these sources of

error to be equal in the control group as in the pathway group, since all members of staff were instructed at the same time in the new documentation routines as part of the implementation of the critical pathway.

This retrospective study stretched over two-and-a-half years. Thus, it is possible that some of the gains that were detected are indicative of a natural movement towards higher performance, which also Panella and co-workers note.⁹ In this context it may be worthy asking whether such a natural movement towards higher performance exists. Our belief is that various development projects provide knowledge on clinical work. Thus, the development and implementation of the critical pathway is part of a so-called natural development. However, patient characteristics and peroperative factors were similar for the control and pathway groups, indicating that these did not have an effect on the patient's postoperative care. The study indicates that the decisive factor for the differences detected in postoperative care was the introduction of the pathway. The critical pathway studied here was implemented in only one Swedish hospital and since pathways are specifically designed for in relation to a certain group of patients suffering from specific diseases or undergoing the same treatment, the results of this study can only be considered to reflect the impact of the critical pathway for patients who have undergone elective aortic-surgery at the hospital studied. However, we believe that this pathway could easily be implemented by motivated staff at any Swedish ICU performing elective aortic-surgery.

The work with development, implementation and evaluation of the critical pathway have given "ripple effect" and created new lessons, practices and procedures. In the clinical work we experience that an evidence-based thinking is established among the staff. After the pathway for patients undergoing aortic-surgery several pathways for other diagnoses have been developed and introduced at the ICU.

Even if this study has shown that nursing intervention is preformed earlier after the introduction of the critical pathway other crucial elements that are essential components for the quality of care should be considered. Therefore, further evaluation and future research must consider the impact of the pathway on health care staff and the patient's satisfaction with the care.

Conclusion

Based on the results of this retrospective review of patient records, we confirmed that the critical pathway for patients undergoing aortic-surgery has a positive impact on care given. Aortic-surgery patients treated in accordance with the pathway at the ICU received nursing interventions earlier than patients who were treated without the pathway, which is crucial for the quality of care and optimal outcome.

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Critical Pathway for Aortic-Surgery patients

Figure 1 Time from extubation until performed nursing intervention in the control group and the pathway group.

Table 1 Peroperativ bleeding (liter), length of surgery (hours) and length of mechanic ventilation (hours) in the control group and the pathway group.

	Controll group					Pathway group						
	N	Mean	Min.	Max.	SD	N	Mean	Min.	Max.	SD		
Peroperativ bleeding	17	1.86	0.60	5.00	1.402	20	1.63	0.40	4.40	0.952	0.612	-0,59 to 0,99
Length of surgery	17	4.84	1.75	9.25	2.069	20	3.84	2.25	6.00	0.987	0.063	-0,06 to 2,06
Length of mechanic ventilation	17	6.82	3.25	21.75	4.369	20	6.03	3.25	11.25	2.589	0.496	-1,56 to 3,15

Table 2 Time (hours) from extubation until performed nursing interventions in the control group and the pathway group.

	Controll group					Pathway group						
	N	Mean	Min.	Max.	SD	N	Mean	Min.	Max.	SD		
Breathing exercise	17	6,70	0,00	27,75	8,890	20	3,35	0,00	17,00	4,859	0,155	-1,33 to 8,04
Nasogastric tube	14	16,07	3,00	21,00	4,569	10	6,10	0,00	17,50	5,661	<0,001	5,64 to 14,30
Clear fluid	17	15,35	1,00	23,00	5,830	20	8,56	2,00	20,00	6,454	0,002	2,65 to 10,93
Nutrition-drink/meal	16	21,53	14,25	37,75	5,643	20	13,11	1,75	21,50	6,665	<0,001	4,17 to 12,67
Mobilization	17	18,54	8,75	43,75	7,212	20	14,56	3,50	30,00	7,551	0,110	-0,95 to 8,92