Quality Improvement Project

Cervical Spine Collar Removal by Emergency Room Nurses: A Quality Improvement Project

Guillaume Fontaine, RN, MSc, PhD Student (corresponding author)
Faculty of Nursing, Université de Montréal
Graduate Research Assistant
Montreal Heart Institute Research Center
guillaume.fontaine@umontreal.ca
514-376-3330 ext. 3069
Fax: 514-593-7441
Montreal Heart Institute Research Center, Room S-2490
5000 Belanger Street
Montreal, Quebec, Canada, H1T 1C8

Massimo Forgione, RN, BSc, MBA
Nurse Manager, Emergency Room
Honoré-Mercier Hospital, Montérégie-Est Integrated Centre of Health and Social Services
massimo.forgione.cisssme17@ssss.gouv.qc.ca
2750 Laframboise Boulevard
Saint-Hyacinthe, Quebec, Canada, J2S 4Y8

Francis Lusignan, RN, BSc

Registered Nurse

Honoré-Mercier Hospital, Montérégie-Est Integrated Centre of Health and Social Services

francis.lusignan.cisssme17@ssss.gouv.qc.ca

2750 Laframboise Boulevard

Saint-Hyacinthe, Quebec, Canada, J2S 4Y8

Marc-André Lanoue, RN

Assistant Nurse Manager

Honoré-Mercier Hospital, Montérégie-Est Integrated Centre of Health and Social Services

marc-andre.lanoue.csssry17@ssss.gouv.qc.ca

2750 Laframboise Boulevard

Saint-Hyacinthe, Quebec, Canada, J2S 4Y8

Simon Drouin, MD

Emergency Physician

Honoré-Mercier Hospital, Montérégie-Est Integrated Centre of Health and Social Services

rsimondrouin@gmail.com

2750 Laframboise Boulevard

Saint-Hyacinthe, Quebec, Canada, J2S 4Y8

Contribution to Emergency Nursing Practice

- A practice improvement programme to monitor the use of the Canadian C-spine Rule (CCR) by emergency room charge nurses and compare their assessments with those of physicians.

- An overview of challenges and key elements to take into account when training charge nurses to use the CCR to facilitate the safe removal of cervical collars in the alert, orientated, low-risk adult trauma patient.
- Appropriate training and clinical coaching should accompany the implementation of CCR guidelines for nurse-led cervical collar removal in nonspecialized centers.

Abstract

Background: The Canadian C-Spine Rule is a clinical decision aid to facilitate the safe removal of cervical collars in the alert, orientated, low-risk adult trauma patient. Few healthcare settings have assessed initiatives to train charge nurses to use the Canadian C-Spine Rule. This practice improvement project conducted in a secondary trauma center in Canada aimed to: (1) train charge nurses of the emergency room of a secondary trauma center to use the Canadian C-Spine Rule; (2) monitor its' use throughout the project period; (3) compare the assessments of the charge nurses with those of emergency physicians.

Methods: The project began with the creation of an interdisciplinary team. Clinical guidelines were established by the interdisciplinary project team. Nine charge nurses of the emergency room were then trained to use the Canadian C-Spine Rule (three on each eight-hour shift). Canadian C-Spine Rule use was monitored throughout the project period, from June 1 to October 5, 2016.

Results: The three aims of this practice improvement project were attained successfully. Over a five-month period, 114 patients were assessed with the Canadian C-Spine Rule. Charge nurses removed the cervical collar for 54 out of 114 patients (47%). A perfect agreement rate (114 out of 114 patients, 100%) was attained between the assessments of the nurses and those of physicians.

Discussion: This project shows that the charge nurses of a secondary trauma center can use the Canadian C-Spine Rule safely on alert, orientated and low-risk adult trauma patients, as demonstrated by the agreement in the assessments of emergency room nurses and physicians.

Introduction

From 2014 to 2015, more than 2.3 million Canadians were admitted to the emergency room (ER) for a trauma, a motor vehicle collision or an accidental fall [1]. Even though traumatized patients present a risk of cervical spine (c-spine) injury, this risk is estimated to be less than 1% in alert, orientated and low-risk adult trauma patients [2-5].

Description of the problem

The majority of patients with a c-spine immobilization are admitted to the ER by ambulance on a backboard with a cervical collar, a temporary immobilization device to prevent neck movement [6]. Following the assessment of the triage nurse, patients are assigned to the various areas of the ER and kept immobilized until the ER physician performs a medical assessment and a c-spine radiography if necessary. This practice remains widely spread throughout the world, even though the evidence shows negative consequences [4,7]. Indeed, a prolonged c-spine immobilization often has more negative consequences than benefits, such as repercussions on patients' comfort and health [8-10]. Moreover, a recent study found that as much as 38 % of c-spine radiographs were not indicated [11]. The overuse of c-spine radiography when clearing c-spine injury utilizes valuable resources and induces undesirable radiation exposure [11-13].

The Canadian C-Spine Rule (CCR) is a clinical decision aid to guide the removal of cervical collars and the use radiography in patients with low risk trauma [14]. The CCR is applicable with an alert, cooperative and non-intoxicated clientele [4,15]. The use of the CCR is widespread in medical clinical practice to determine the need to perform radiographs in patients with a risk of injury to the c-spine [16]. However, the use of the CCR by nurses is recent in clinical practice. A few studies in this area generally point to a good acceptance of this practice as well as clinical outcomes equivalent to its use by doctors [8,17-19]. The main area of concern is whether nurses in different

102 healthcare settings, such as the ER, have the clinical skills and necessary knowledge to use such
103 guidelines in daily practice.

104 **Barriers**

105 Some barriers to the use of the CCR by nurses are documented in scientific literature [14].
106 Frequently identified barriers include being too busy, lack of time, and excessive workload. Not
107 receiving enough trauma patients to become comfortable using the CCR algorithm can be another
108 difficulty encountered. Moreover, about a tenth of the nurses in the study of Clement, Stiell, Lowe,
109 Brehaut, Calder, Vaillancourt, Perry [14] perceived a lack of support from the medical team.
110 Physician support is indeed vital to reinforce the feeling that using the CCR is safe. However,
111 nurses raise these negative elements far less often than positive ones [14,18].

112 **Available Knowledge**

113 Originally proposed by Stiell, Wells, Vandemheen, Clement, Lesiuk, De Maio, Laupacis,
114 Schull, McKnight, Verbeek, Brison, Cass, Dreyer, Eisenhauer, Greenberg, MacPhail, Morrison,
115 Reardon, Worthington [4], the CCR has quickly become the most widely used clinical decision aid
116 to assess the need to immobilize the c-spine of trauma patients and perform radiographs to assess
117 the presence of fracture(s). A large prospective cohort study conducted among 8 283 patients
118 compared the sensitivity of the CCR with the criteria of the National Emergency X-Radiography
119 Utilization Study (NEXUS). The study showed the superior sensitivity of the CCR compared to
120 the NEXUS (99.4% vs. 90.7%, P <0.001) [15]. A systematic review supported these results [16].
121 The CCR is applicable only in stable patients with a Glasgow Coma Scale score of 15 out of
122 15. This means that patients must open their eyes spontaneously, be able to obey instructions
123 (motor function) and be orientated in regard to person, place, date, and time. The CCR is based on

three high-risk criteria, five low-risk criteria, and the ability for patients to rotate the neck (see Figure 1). If the patient presents one of three high-risk criteria, immobilization should be maintained until the medical evaluation and x-rays. If the patient has any of the five low-risk criteria without any high-risk criteria, the clinician can remove the cervical collar and ask the patient to mobilize his neck. If the patient can turn his neck to 45 degrees right and left by himself, the cervical collar can be removed and the realization of radiographs is no longer necessary [11,14].

Figure 1. The Canadian C-Spine Rule.

a. **Dangerous mechanism**: fall from an elevation of ≥ 3 feet/5 stairs, axial load to head (i.e., diving), high risk motor vehicle collision (i.e., > 100 km/h, rollover, ejection), motorized recreational vehicles, bicycle struck or collision.
b. **Simple rear-end motor vehicle collision excludes**: pushed into oncoming traffic, hit by bus/large truck, rollover, hit by high speed vehicle.
c. **Delayed**: not immediate onset of neck pain.

Several strategies can be mobilized to facilitate nurses' use of the CCR. First, the proactive support of the trainer(s) and the ER managers is seen as the main enabler for the use of the CCR by nurses [14]. Second, it is important to form local leaders (or champions) to provide clinical support for nurses to use the CCR throughout the project [14]. Third, working closely with the medical team of the project is also an important aspect in the success of the implementation of the guidelines. Finally, items such as reminders, posters and documents distributed to the ER nurses seem to have a positive effect on the use of the CCR [14].

Specific aims

This practice improvement project conducted in a secondary trauma center in Canada had three aims: (1) to train the charge nurses of the ER of a secondary trauma center on each shift to use the CCR to remove the cervical collar in the alert, orientated, low risk, adult trauma patient; (2) to monitor the use of the CCR throughout the project period; (3) to compare the assessments of

the charge nurses using the CCR to the assessments done by emergency physicians on the same patients.

Methods

This practice improvement project was conducted after a literature review over a 8-month period from February to October 2016. A timeline demonstrating the process is provided in Figure 2. This paper is reported in accordance with the Standards for Quality Improvement Reporting Excellence (SQUIRE) 2.0 Guidelines [20].

Figure 2. Timeline of the practice improvement project.

This project was conducted in a secondary trauma center in Quebec, Canada, defined as an establishment offering general surgical services, orthopedics, intensive care, and rehabilitation services [21]. Since this was a practice improvement project, it was not submitted to a research ethics committee. However, it received the approval of the hospital board, the managers of the ER, the medical team of the ER and the nurses involved in the project.

The project was conducted in an ER in which approximately 100 nurses and 20 doctors work on day, evening and night shifts. In 2015–2016, the number of annual visits was 43 375. During this period, 698 individuals involved in motor vehicle accidents with cervical immobilization were admitted to the ER. In the same period, 358 multiple trauma diagnoses were received. In addition, 2 563 people were admitted for a fall. The large volume of patients at risk of injury to the c-spine and was one of the motivations for this project.

Creation of an interdisciplinary team

The project began with the creation of an interdisciplinary team involving two nursing

managers, one ER physician, and two ER registered nurses. Project aims and the project methodology were collaboratively established by the project team.

The entire medical team of the ER was involved in the project as early as possible in order to maximize their commitment thereafter. The project team met all the physicians of the ER four months before the start of the CCR implementation with the clinical practice nurses. Meetings held with the medical team aimed to expose the clinical relevance of the project, justifying the involvement of nurses in the removal of cervical collars. In addition, the project team presented the project methodology and anticipated benefits. Finally, the project team gathered the comments and concerns of the medical team. Physicians were informed that their collaboration would be required to proceed with the coaching of nurses for the removal of cervical collars with the CCR guidelines. It was vital to ensure their cooperation for the successful use of the CCR by charge nurses in this project [14].

Selection of the nurses on different work shifts

One of the concerns of the medical team was the selection of sufficiently skilled and experienced nurses so that the project could proceed safely. Existing scientific literature recommends the training of nurses with several years of experience to maximize the success of the project [14,18]. Therefore, it was decided that the nine charge nurses of the ER, on day, evening and night shifts, would be trained to use the CCR during the first phase of the project. No charge nurses were left out of the project.

Training the charge nurses to use the CCR

One ER registered nurse and one ER physician trained the nine charge nurses. The training lasted three hours and had the following aims: (1) to describe the clinical reasoning and the

justifications underlying the practice improvement project; (2) to explain to the charge nurses why they were selected; (3) to explain the aims of the practice improvement project; (4) to explain how and under which circumstances the CCR works; (5) to demonstrate how to use the CCR through simple clinical situations.

Clinical use of the CCR by charge nurses

The clinical use of the CCR by the charge nurses began one week after the training. The practice improvement project was conducted over 5 months, from June 1 to October 5, 2016.

In order for all nurses of the ER to be informed of the project, a message was published in the weekly newspaper of the ER during the first week of the project. In this message, ER nurses were advised to refer patients with cervical collars to the charge nurses on different shifts. In this way, the charge nurses could assess the patients with cervical collars and use the CCR algorithm to decide if it was desirable to remove the cervical collar. Throughout the project, ER physicians validated each decision of the charge nurses to remove or not remove the cervical collars. The medical team also provided clinical coaching and answered questions from the charge nurses regarding the use of the CCR.

Monitoring of the clinical use of the CCR use by charge nurses

We used a standardized and systematic approach to monitor the clinical use of the CCR by charge nurses throughout the project. For each patient with a cervical collar assessed by a charge nurse, a worksheet was completed and filed in a binder at the nursing station, as presented in Figure 3.

Figure 3. The worksheet used in the quality improvement project.

These worksheets allowed the validating of the assessments performed by the charge nurses as well as close monitoring of the number of cervical collars removed according to the CCR.

Charge nurses consigned key elements to the nursing documentation: the respect of the CCR criteria; the physical assessment; the nature of the report to the physician or the physician's assessment; and the decision to remove, or not remove the cervical collar.

Results

From June 1 to October 5, the charge nurses involved in the present project assessed a total of 114 patients with cervical collars with the CCR. The assessment of these 114 patients was consigned to the standardized form presenting the CCR criteria and to the nursing documentation. An ER physician also assessed every patient assessed by a RN in order to validate their assessment and their decision to remove the cervical collar.

Of the 114 patients assessed, 54 (47 %) had their cervical collar removed following the assessment of the charge nurses involved.

Since they did not conform to the criteria of the CCR, 60 patients out of 114 (53 %) kept their cervical collar following the assessment of the charge nurses. The criterion most frequently cited for not removing the c-spine immobilization was the age of patients in 28 % of instances (below 18 years old or over 65 years old).

Of the 114 cases studied, two patients presented ambiguous or unspecified high-risk criteria, which after the nursing assessment, led to the maintenance of the cervical collar. These two cervical collars were removed after the medical examination, but the CCR training was very clear in stating that when there is doubt or discomfort about the application of CCR, it is preferable to keep the cervical collar. Hence, for these two patients, the physicians agreed with the nurses decision, based

on their protocol, but chose to remove the collar anyways. However, the physicians agreed with the nurses decision, based on their protocol, 100% of the time

In sum, physicians agreed with the nurses' decisions to remove or not remove the cervical collar in 114 out of 114 patients (100 %).

Discussion

We achieved the three aims of our practice improvement project. First, we trained nine ER charge nurses to use the CCR to remove cervical collars in alert, orientated, low risk, adult trauma patients. Second, we monitored the use of the CCR throughout the project period. Third, we compared all the assessments of the ER charge nurses to the assessments of the ER physicians. Our results show that training experienced ER charge nurses to use the CCR is both feasible and safe. Key success factors were strong project leadership, the creation of an interdisciplinary partnership including all members of the medical team, the selection of experienced nurses to participate in the project, the appropriate training of charge nurses to use the CCR, and close monitoring of the outcomes of the project.

Approximately half of the patients (54 out of 114, 47%) had their cervical collar removed following the assessment of the charge nurse, underlining the potential benefits of implementing the CCR on a larger scale [4,17]. This practice improvement project also illustrates how the use of the CCR by nurses can potentially affect the time patients spend on a stretcher before seeing an ER physician, the ER patient flow, and patient comfort [18].

It is important to note that ER physicians validated all assessments realized by charge nurses in the present project. A perfect agreement rate (100%) was attained between the assessments of the ER charge nurses and the assessments of the ER physicians. This rate is higher than what was observed in previous research [18]. The positive results of this practice improvement project may be

explained by the selection of highly experienced charge nurses and the extensive clinical coaching on the correct use of the CCR.

The charge nurses raised some issues during this practice improvement project which could inform clinical practice and future projects. First, some of the charge nurses trained to use the CCR were apprehensive about its application in clinical practice. Some of the concerns raised in the scientific literature [14,22], such as doubts regarding the safety of the algorithm and the manipulations to be carried out, sometimes hampered the application of the CCR by the nurses in this project. Second, charge nurses sometimes felt the process of cervical collar removal with the CCR was time-consuming, particularly when it came to validating their clinical impressions with an ER physician and documenting the cervical collar removal in their notes. This is partially explained in our project by the necessity to validate the assessment made with an ER physician, which would not be necessary in daily practice when the CCR would be implemented. Regarding the nursing documentation of the CCR, nursing managers should consider how to standardize and systematize the way nurses document their assessments and decisions regarding cervical collar removal.

The next step of the present practice improvement project is to develop a plan to determine how and when the other ER nurses will be trained to use the CCR for cervical collar removal. Indeed, in this project, we only included experienced charge nurses for safety reasons. However, questions arose regarding the training of other nurses working in the triage area, the trauma room, and the ambulatory area of the ER. The scientific literature on this subject is not entirely clear, with some studies recommending the training of only triage nurses, and other studies expanding the use of CCR to a wider nursing population [14,19].

Implications for Emergency Nursing

This paper contributes a practice improvement program to monitor the use of the CCR by ER charge nurses and compare their assessments with those of physicians. It provides an overview of challenges and key elements to take into account when training charge nurses to use the CCR to facilitate the safe removal of cervical collars in the alert, orientated, low-risk adult trauma patient. It also highlights that appropriate training and clinical coaching should accompany the implementation of CCR guidelines for nurse-led cervical collar removal in nonspecialized centers.

We believe that when the evidence will build towards the benefits of Canadian C-Spine Rule use, in terms of increased patient comfort and satisfaction, decreased ER admission times and decreased imaging, physicians and emergency department managers will work towards developing standing orders for trained nurses to remove c-spine collars for patients meeting CCR criteria.

Conclusions

This practice improvement project showed that the charge nurses of a secondary trauma center can safely use the CCR for cervical collar removal. Moreover, ER charge nurses achieved similar results to ER physicians when using the CCR algorithm. The ER nurses and the medical team demonstrated great interest and engagement in the project. Strong positive leadership from the managers of the ER allowed for the optimization of project progression.

Health care organizations can use the results of this practice improvement project to develop programs aiming to train and coach ER nurses to use the CCR guidelines.

References

1. CIHI. Emergency visits: Volumes and median length of stay per triage level, outcome of visit and main problem. 2016; https://apps.cihi.ca/mstrapp/asp/Main.aspx?server=apmstrextprd_i.cihi.ca&project=Quick%20Stats&uid=pce_pub_fr&pwd=&evt=2048001&visualizationMode=0&documentID=8A3FAB3E46D03C93AE5F82AD01FE74D9. Accessed 5 mai, 2016.

2. Reid DC, Henderson R, Saboe L, Miller JD. Etiology and clinical course of missed spine fractures. *Journal of Trauma.* 1987;27:980-986.

3. Diliberti T, Lindsey RW. Evaluation of the cervical spine in the emergency setting: who does not need an x-ray? *Orthopedics.* 1992;15:179-183.

4. Stiell IG, Wells GA, Vandemheen KL, et al. The Canadian C-Spine Rule for Radiography in Alert and Stable Trauma Patients. *The Journal of the American Medical Association.* 2001;286(15):1841-1848.

5. Canadian CT Head and C-Spine (CCC) Study Group. Canadian C-Spine Rule study for alert and stabletrauma patients: I. Background and rationale. *CJEM.* 2002;4:84-90.

6. Abram S, Bulstrode C. Routine spinal immobilization in trauma patients: what are the advantages and disadvantages? *The Surgeon: Journal of the Royal Colleges of Surgeons of Edinburgh and Royal College of Surgeons in Ireland.* 2010;8(4):218-222.

7. Hood N, Considine J. Spinal immobilisation in pre-hospital and emergency care: a systematic review of the literature. *Australasian Emergency Nursing Journal.* 2015;18(3):118-137.

8. Pitt E, Pedley DK, Nelson A, Cumming M, Johnston M. Removal of C-spine protection by A&E triage nurses: a prospective trial of a clinical decision making instrument. *Emergency Medicine Journal: EMJ.* 2006;23(3):214-215.

9. Brown JB, Bankey PE, Sangosanya AT, Cheng JD, Stassen NA, Gestring ML. Prehospital spinal immobilization does not appear to be beneficial and may complicate care following gunshot injury to the torso. *Journal of Trauma and Acute Care Surgery.* 2009;67(4):774-778.

10. Haut ER, Kalish BT, Efron DT, et al. Spine Immobilization in Penetrating Trauma: More Harm Than Good? *Journal of Trauma and Acute Care Surgery.* 2010;68(1):115-121.

11. Paxton M, Heal CF, Drobetz H. Adherence to Canadian C-Spine Rule in a regional hospital: A retrospective study of 406 cases. *Journal of Medical Imaging and Radiation Oncology.* 2012;56(5):514-518.

12. Vandemark RM. Radiology of the cervical spine intrauma patients: practice pitfalls and recommenda-tions for improving efficiency and communication. *American Journal of Roentgenology.* 1990;155:465-472.

13. Gbaanador GB, Fruin AH, Taylon C. Role of routine emergency cervical radiography in head trauma. *Am J Surg.* 1986;152:643-648.

14. Clement CM, Stiell IG, Lowe MA, et al. Facilitators and barriers to application of the Canadian C-spine rule by emergency department triage nurses. *Int Emerg Nurs.* 2016.

15. Stiell IG, Clement CM, McKnight RD, et al. The Canadian C-Spine Rule versus the NEXUS Low-Risk Criteria in Patients with Trauma. *The New England Journal of Medicine.* 2003;349(26):2510-2518.

16. Michaleff ZA, Maher CG, Verhagen AP, Rebbeck T, Lin CWC. Accuracy of the Canadian C-spine rule and NEXUS to screen for clinically important cervical spine injury in patients following blunt trauma: a systematic review. *Canadian Medical Association Journal.* 2012;cmaj-120675.:1-10.

17. Miller P, Coffey F, Reid AM, Stevenson K. Can emergency nurses use the Canadian cervical spine rule to reduce unnecessary patient immobilisation? *Accid Emerg Nurs.* 2006;14(3):133-140.

18. Smith N, Curtis K. Can emergency nurses safely and accurately remove cervical spine collars in low risk adult trauma patients: An integrative review. *Australas Emerg Nurs J.* 2016.

19. Stiell IG, Clement CM, O'Connor A, et al. Multicentre prospective validation of use of the Canadian C-Spine Rule by triage nurses in the emergency department. *CMAJ.* 2010;182(11):1173-1179.

20. SQUIRE. Explanation and Elaboration of SQUIRE 2.0 Guidelines. 2017; http://www.squire-statement.org/index.cfm?fuseaction=Page.ViewPage&pageId=504, 2017.

21. Institut national d'excellence en santé et services sociaux du Québec. Centres de traumatologie secondaires. 2016; http://fecst.inesss.qc.ca/fr/maillons/centres-secondaires.html.

22. Rossettini G, Rondoni A, Testa M. Application of the Canadian C-Spine Rule during early clinical evaluation of a patient presenting in primary care with a C2 fracture following a motor vehicle collision: A case report. *International Journal of Osteopathic Medicine.* 2015;18(3):230-236.

Figure 1. The Canadian C-Spine Rule.

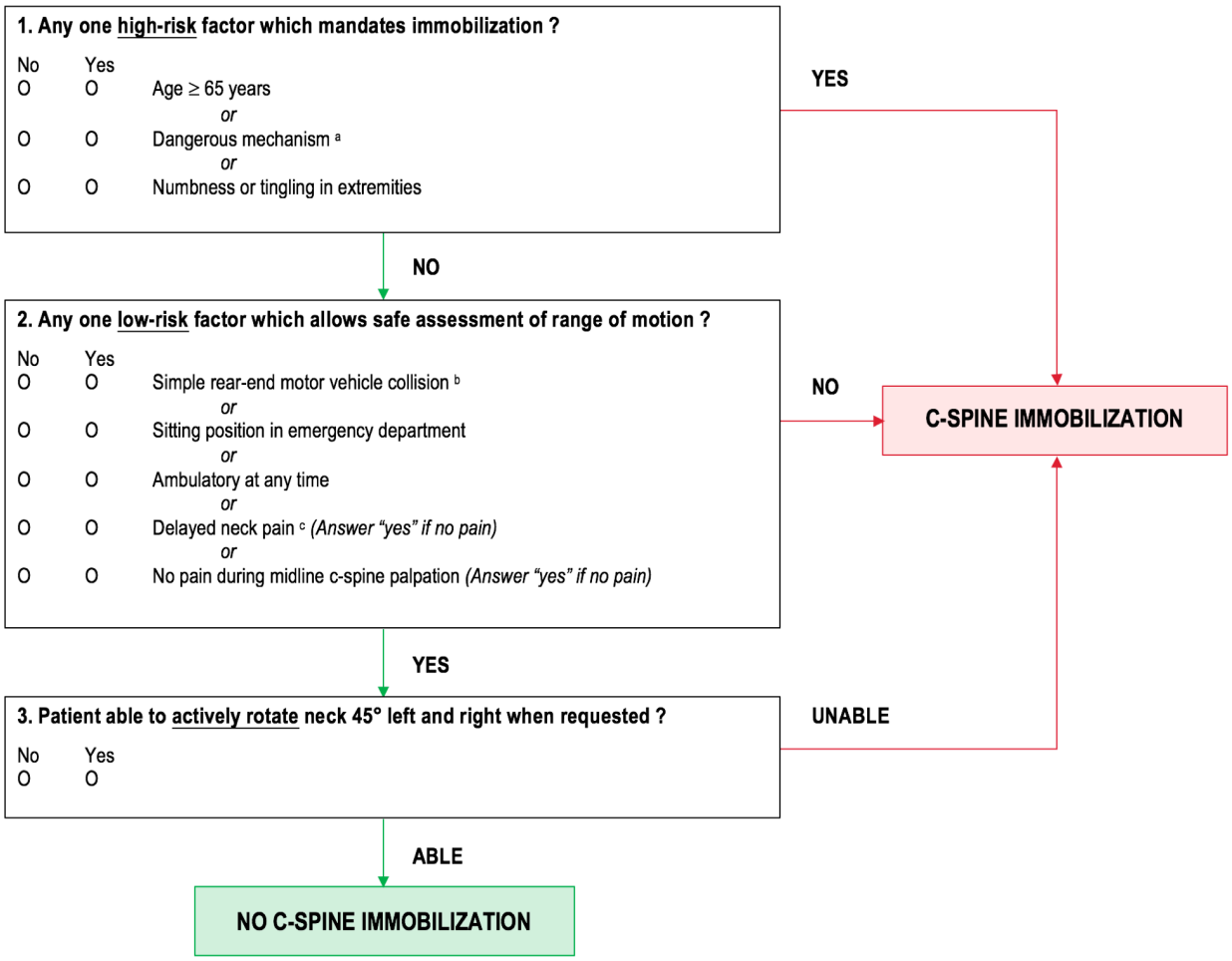
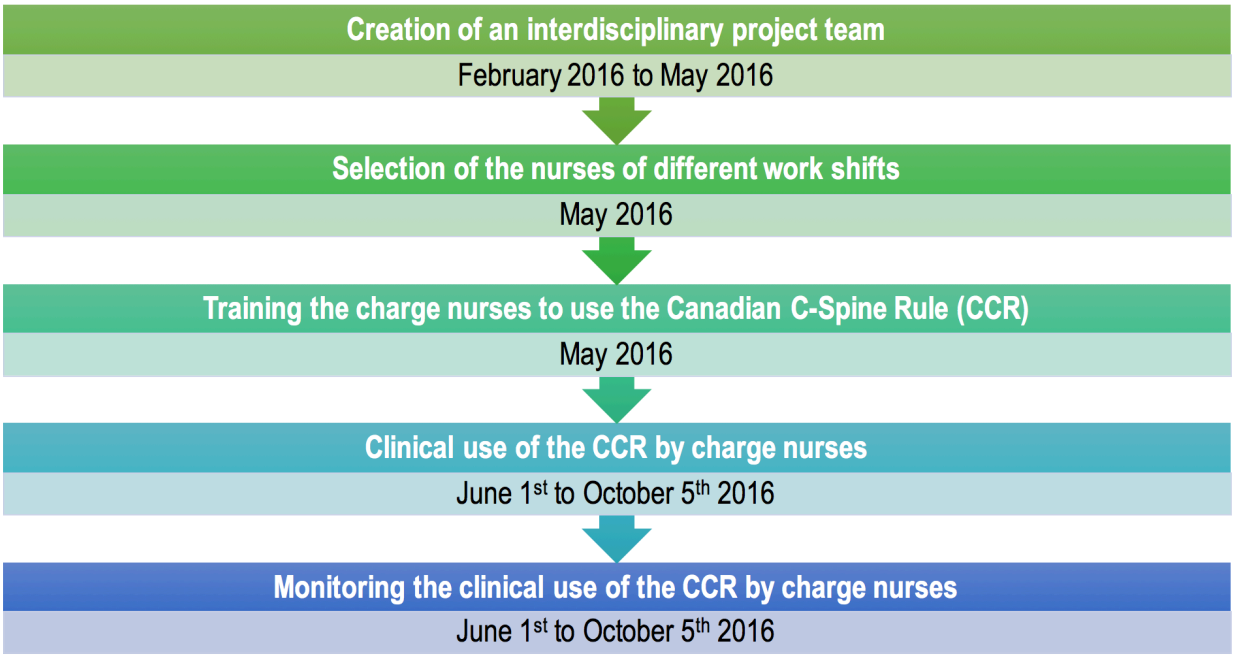


Figure 2. Timeline of the practice improvement project.



383 *Figure 3*. The worksheet used in the quality improvement project.

CERVICAL SPINE COLLAR REMOVAL WORKSHEET
(Based upon the Canadian C-Spine Rule)

SECTION 1. Patient, charge nurse and physician identification

a) Patient identification : Name _____ Surname _____ Chart # _____
b) Charge nurse identification : Name _____ Surname _____
c) Physician identification : Name _____ Surname _____

SECTION 2. Canadian C-Spine Rule (CCR) Criteria

a) Any one high-risk criteria which mandates immobilization?

No	Yes	
O	O	Age ≥ 65 years
O	O	Dangerous mechanism [a]
O	O	Numbness or tingling in extremities

b) Any one low-risk criteria which allows safe assessment of range of motion?

No	Yes	
O	O	Simple rear-end motor vehicle collision [b]
O	O	Sitting position in emergency department
O	O	Ambulatory at any time
O	O	Delayed neck pain [c] *(Answer "yes" if no pain)*
O	O	No pain during midline c-spine palpation *(Answer "yes" if no pain)*

c) Any age restriction applicable, preventing the use of the CCR?

No	Yes	
O	O	Age ≤ 17 years old
O	O	Age ≥ 66 years old

SECTION 3. Physical assessment of the patient

a) Does the patient present any one of these symptoms? Paresthesia of the extremities; Cervical tenderness; Pain during head rotation; Pain during the flexion and the extension of the neck.

No	Yes
O	O

b) Is the patient able to actively rotate neck 45° left and right when requested?

No	Yes
O	O

SECTION 4. Decision of the charge nurse to remove the cervical collar

No	Yes
O	O

SECTION 5. Decision of the physician to remove the cervical collar

No	Yes
O	O

SECTION 6. Notes

_____
_____
_____

384