The Knee xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Does different duration of non-operative immobilization have an effect on the redislocation rate of primary patellar dislocation? A retrospective multicenter cohort study

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ARTICLE INFO

Article history:
Received 21 March 2017
Received in revised form 10 September 2017
Accepted 4 October 2017
Available online xxxx

Keywords:
Patellar dislocation
Immobilization
Radiology imaging
Rehabilitation
Athletic injuries
Knee

ABSTRACT

Background: Immobilization devices such as plaster splints, casts and braces have been used for first time patellar dislocation (FTPD) in order to prevent redislocation. This study evaluates different non-operative immobilization regimes upon rates of redislocation.
Methods: A retrospective cohort study with a study population of 1366 in which 601 subjects under 30 years with FTPD were included from three hospitals. Exclusion criteria were osteochondral fracture, ligament injury and subluxation. Subjects were divided into five groups; unknown/none, two weeks of brace, two weeks of brace followed by bandage, four weeks of brace and six weeks of brace with increasing of range of motion. Radiographs were evaluated for trochlear dysplasia (TD), patella alta, trochlear depth and growth zone. Crude analysis and logistic regression adjusted for radiographic assessments, age, gender and rehabilitation was done in STATA® with significance $p \leq 0.05$.
Results: Forty-five point eight percent were between 15 and 19 years and 51.4% were male. One hundred sixty-three experienced redislocation (27.1%). Logistic regression was performed at 404 subjects and showed that rehabilitation, gender, TD, patella alta, and growth zone had no significant odds ratio (OR) on redislocation. The duration of brace demonstrated no significant OR in reducing redislocation. Subjects between 20 and 29 years showed lower OR in redislocation (95% CI) of 0.27 (0.11; 0.64, $p = 0.003$).
Conclusion: This study demonstrated no difference in duration of brace treatment in reducing patella redislocation after FTPD. Rehabilitation and predisposal factors such as TD, trochlear depth, patella alta and open growth zone did not influence the redislocation rate. Increasing age reduced risk of redislocation.

1. Introduction

First time patellar dislocation (FTPD) in the knee predominantly affects younger people. Recurrent patellar dislocation can lead to reduced quality of life and significantly affect the mobility as well as the level of activity [2,28]. Several anatomical variants recognized radiologically as trochlear dysplasia (TD), patella alta, increased femoral anteversion, and lateralization of the tibial

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https://doi.org/10.1016/j.knee.2017.10.002
0968-0160/

tuberosity have been identified to be important factors predisposing to patellar instability [1,8,10,15–17,29]. Except in those cases with osteochondral fracture; non-operative management has been the approach of choice in FTPD for many years [4,5,23,30].

To prevent redislocation of the patella various types of immobilization devices, such as plaster splints, cylinder casts and braces have been used to restrict knee flexion [28]. However, few studies have focused on the efficacy of the various immobilization regimens. Mäenpää and Lehto [20] found in a retrospective study that posterior plaster splints had the lowest redislocation rate compared to a cylinder cast or bandage/brace. In a prospective randomized trial from Rood et al. [25] comparing tape versus cast for the prevention of recurrent patellar dislocation, no difference in the rate of redislocation was found.

The durations of immobilization vary, but most of them last two to six weeks [7,25,26,27]. An algorithm presented by Mehta et al. [19] suggests that six weeks of immobilization yields the lowest redislocation rate, while less than three weeks may result in higher redislocation rates. In a review by Van Gemert et al. [32] it was concluded that the optimal duration of immobilization is still uncertain.

The purpose of this retrospective study was to evaluate how different immobilization regimens for participants with FTPD affect the rate of redislocation and to analyze radiographic parameters that might predict redislocation.

2. Methods

This is a multicenter retrospective cohort study from three hospitals, differing in their guidelines on the non-operative strategy for FTPD. The Institutional Review Board approved the study. Approval was also obtained from the Danish Data Protection Agency (case numbers 14/15156 and 47/2014) and from the Danish Health Authority (case number 3-3013-844/1).

2.1. Participant

The study population was subjects below the age of 30 years with FTPD registered in the emergency departments of three referral hospitals between 1st of January 2009 and 31st of December 2013. The International Classification of Diseases (ICD-10) code DS830 for patella dislocation was used to identify the subjects with FTPD. Subsequently, the Central Personal Identification Number (CPR-nr.) of each subject was obtained from the three hospitals' electronic health database. The CPR-nr. was linked to the subject's health records, which were available as electronic files within the health database. The health record was studied along with accessible radiographic images, which were also available as electronic files. All health records were reviewed regarding redislocation from primary dislocation.

From January to March 2014, the data were retrieved for inclusion and exclusion criteria:

Inclusion:

1. Age younger than 30 years at the time of injury
2. A history of a single episode (traumatic or atraumatic) of patellar dislocation with clinical lateral dislocation of the patella or a history of their kneecap visibly popping out of the joint

Exclusion:

1. Osteochondral fracture
2. Wrong diagnoses or miscoded. If subject were coded for distortion, sub-dislocation and anterior knee pain they were not registered as patella dislocation
3. History of previous dislocation in the affected knee or health records which indicate that this may have happened
4. Previous or simultaneous cruciate or collateral ligament injury to the affected knee
5. Uncertain history of dislocation or sub-dislocation of the patella

The inclusion and exclusion criteria could only be determined if they were present in the health record.

There were 1366 eligible subjects in total and due to the exclusion criteria, 765 subjects were excluded (Figure 1). This left 601 subjects for inclusion. It was possible to divide the subjects into five groups with different durations of brace fixation after reviewing their health records:

1. Unknown or no immobilization without any knee brace or patella stabilizing bandage.
2. Two weeks of fixed knee brace in 20–30° without further fixation or bandage.
3. Two weeks of fixed knee brace in 20–30° followed by a patella stabilizing bandage.
4. Four weeks of fixed knee brace in 20–30° without further fixation or bandage.
5. Six weeks of knee brace that was initially fixed in 30° range of motion (ROM), which was then gradually increased every second week respectively in 60 ROM and 90° ROM.

The compliance of the treatment regimens was investigated in the subjects' health record. Subjects who did not follow the follow-up time according to the treatment regimen were included in the group of unknown.

A primary endpoint was defined as the rate of patellar redislocation relative to the durations of brace treatment. Secondary endpoints were defined as the influence of rehabilitation treatments on the rate of patellar redislocation and how radiographic measurements such as TD and patella alta was able to predict new patellar dislocations. Rehabilitation consisted of sessions with a physiotherapist in which subjects were instructed in exercises with the purpose of strengthening muscles such as vastus medialis obliquus (VMO). In some cases, subjects were solely given brochures on exercises. The date of FTPD, the date of any redislocation of

Please cite this article as: Kaewkongnok B, et al, Does different duration of non-operative immobilization have an effect on the redislocation rate of primary patellar dislocation? A retrospective ..., Knee (2017), https://doi.org/10.1016/j.knee.2017.10.002