

Original Article

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Validity of sports-related diagnosis codes in the Danish National Patient Register

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ABSTRACT

INTRODUCTION The diagnosis codes for sports-related injuries in the Danish National Patient Register (DNPR) are frequently used for research. Even so, their validity remains unknown. The aim of this study was to establish the validity of sports-related diagnosis codes in the DNPR.

METHODS The study was conducted as a registry study in the DNPR investigating the diagnosis codes for acute Achilles tendon rupture, Achilles tendinitis, anterior cruciate ligament (ACL) rupture, dislocation of the patella, traumatic tear of the meniscus and degenerative meniscal lesion. For each diagnosis code, patient records were retrieved. We considered a positive predictive value (PPV) of 80% or higher to be satisfying.

RESULTS A total of 523 patients were included. The PPV for acute Achilles tendon rupture was 98% (95% confidence interval (CI): 92-100%), for Achilles tendinitis 85% (95% CI: 74-92%), for ACL rupture 96% (95% CI: 88-99%) and for dislocation of the patella 96% (95% CI: 90-99%). Depending on the diagnosis definition used, the PPVs were 56-72% for traumatic tear of the meniscus and 53-77% for degenerative meniscal lesion.

CONCLUSIONS This study documented an acceptable validity allowing for epidemiological research of the diagnosis codes for acute Achilles tendon rupture, Achilles tendinitis, ACL rupture and dislocation of the patella. The diagnosis codes for traumatic tear of the meniscus and degenerative meniscal lesion showed a lower validity, and thus caution should be taken when using these codes.

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TRIAL REGISTRATION The study was approved by the Danish Data Protection Agency and the Danish Patient Safety Authority.

In past decades, sports participation and the number of sports-related injuries have increased in Denmark [1]. Epidemiological research within this field contributes with unique knowledge about risk factors, incidence trends and treatment quality [2]. One of the main sources of data in Denmark is the Danish National Patient Register (DNPR) [3]. The register is a valuable tool for epidemiological research, provided data are valid [3, 4].

The diagnosis codes for sports injuries are frequently used for research and assessment of data quality in clinical databases [2]. However, the validity of these diagnosis codes remain unknown. Knowing the validity of data is essential for bias assessment [4].

The aim of this study was to establish the validity of reporting of diagnosis codes to the DNPR based on the patient records for some of the most common lower limb sports injuries; acute Achilles tendon rupture [2],

Achilles tendinitis [5], rupture of the anterior cruciate ligament of the knee (ACL rupture) [6], dislocation of the patella [7], traumatic tear of the meniscus and degenerative meniscal lesion [8].

METHODS

The study was a registry study comparing data from the DNPR with patient records. The study investigated whether the diagnosis codes found in the DNPR are similar to those noted by the physician in the patient records. It is not possible with the current data and methodology to investigate if the correct diagnosis was given by the physician. The investigated diagnoses were acute Achilles tendon rupture, Achilles tendinitis, ACL rupture of the knee, dislocation of the patella, traumatic tear of the meniscus and degenerative meniscal lesion.

The Danish National Patient Register

The DNPR was established in 1976. Hospitals are obligated to report International Classification of Diseases, tenth version (ICD-10), and Sundhedsvæsenets Klassifikations System codes for all treatments and operations linked to the patient through the unique civil registration number [3].

Population

For each diagnosis code, 100 randomly selected patient records were retrieved from Hvidovre Hospital covering incidents in the period from 1 January to 31 December 2017. If fewer than 100 patients had the diagnosis code in this period of time, all patients were included.

Validity

The validity of a diagnosis code was measured as the positive predictive value (PPV), which was defined as the number of patients registered with a correctly registered diagnosis code in the DNPR out of the total number of patients who should be coded with the diagnosis code according to the notes in the patient records [3]. We considered a PPV of 80% or higher for a diagnosis code to be acceptable.

Definition of diagnoses

A diagnosis code needed to be supported by information in the patient record confirming the diagnosis code. If a diagnosis was based on findings on magnetic resonance imaging (MRI), ultrasound or by exploratory surgery, the diagnosis code was confirmed. In cases without medical imaging or surgery, the following pre-defined diagnostic criteria were applied to confirm the diagnosis:

Acute Achilles tendon rupture, ICD-10 DS86.0A

One of the following: 1. A positive calf squeeze test and a palpable gap at the site of the rupture. 2. A positive calf squeeze test, lack of the ability to push off during walking and to plantarflex against resistance [9].

Achilles tendinitis, ICD-10 DM76.6

Two of the following: 1. A gradual pain development in the Achilles tendon either midportion or by its insertion on the calcaneus that varied in intensity. 2. Pain in the Achilles tendon that would decrease during exercise only to recur hours later [9]. 3. Pain in the Achilles tendon that had been ongoing for a period of six weeks or more. 4. A palpable thickening at the midportion of the Achilles tendon [10].

Rupture of the anterior cruciate ligament of the knee, ICD-10 DS83.5E

One of the following: a positive Lachman test, pivot shift test or anterior drawer test [9].

Dislocation of the patella, ICD-10 DS83.0

A patient history of patella dislocation.

Meniscal lesions

The diagnoses traumatic tear of the meniscus and degenerative meniscal lesion are subject to diverse definitions in the literature [11]. Three different definitions found in the literature were applied for each of the two diagnosis codes for meniscal lesions: 1. A trauma-based definition in which the presence of a trauma as a trigger of the pain distinguished between a traumatic tear of the meniscus and a degenerative meniscal lesion [11-13]. 2. A time-based definition in which the duration of symptoms of less or more than three months distinguished between a traumatic tear of the meniscus and a degenerative meniscal lesion [14]. 3. A broad problem-based definition in which any kind of meniscal lesion was accepted valid.

Traumatic tear of the meniscus, ICD-10 DS83.2

Trauma-based definition: A clinical history of knee pain stemming from a knee distortion trauma and a positive compression-rotation test (McMurray's test, Apley's test or the Thessaly test).

Time-based definition: A clinical history of joint line tenderness developing within three months of the clinical assessment and a positive compression-rotation test.

Problem-based definition: A clinical history of knee pain and a positive compression-rotation test.

Degenerative meniscal lesion, ICD-10 DM23.2

Trauma-based definition: a clinical history of knee pain NOT caused by trauma of the knee and a positive compression-rotation test.

Time-based definition: a clinical history of chronic knee pain (more than three months) and a positive compression-rotation test.

Problem-based definition: a clinical history of knee pain and a positive compression-rotation test.

Review of patient records

The review of patient records was conducted by the first author. In case of doubt, the last author was consulted. Patient records were reviewed including notes from the emergency room, the outpatient clinics and paraclinical examinations such as MRI and ultrasound using an electronic patient record software application.

Statistical analysis

Confidence intervals were calculated by use of exact binomial tests. All analyses were performed using R 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

Trial registration: The study was approved by the Danish Data Protection Agency (no. P-2019-187) and the Danish Patient Safety Authority.

RESULTS

From 1 January 2017 to 31 December 2017, a total of 1,399 patients were registered with one of the six diagnoses. A total of 85 patients were registered with traumatic Achilles tendon rupture, 65 were registered with Achilles tendinitis, 73 were registered with ACL rupture, 140 with dislocation of the patella, 428 with traumatic tear of the meniscus and 608 with degenerative meniscal lesion. One hundred patients were randomly selected among the patients registered with dislocation of the patella, traumatic tear of the meniscus and degenerative meniscal lesion. Selection was done manually by the first author from a list including only the diagnosis code and the

unique patient identifier. The 100 patients were selected based on a random visual spread of patients from the list.

The calculated PPVs are presented in Table 1.

TABLE 1 Validity of diagnosis codes for sports injuries of the Achilles tendon and the knee registered in the Danish National Patient Register.

Degenerative meniscal lesion, diagnosis code M group 23.2	PPV% (95% CI) [correct diagnosis/diagnosis code^a, n]
Trauma-based definition	53 (43-63) [53/100]
Time-based definition	60 (50-70) [60/100]
Problem-based definition	77 (68-85) [77/100]

CI = confidence interval; PPV = positive predictive value.

a) Patients with correct diagnosis/patients registered with the diagnosis code.

DISCUSSION

This study documented an acceptable validity in the 85-98% range for four of the six diagnoses investigated in the DNPR: Acute Achilles tendon rupture, Achilles tendinitis, rupture of the anterior cruciate ligament of the knee and dislocation of the patella. The high validity of the diagnosis codes implies that they may be used for epidemiological research within the field. The remaining two diagnoses, traumatic tear of the meniscus and degenerative meniscal lesion, showed a lower validity which fell in the 53-77% range depending on the definition of the diagnoses. Therefore, the two diagnosis codes should be used with caution.

No previous studies have investigated the validity of sports-related orthopaedic diagnosis codes in the DNPR. Several studies have investigated the validity of other diagnosis codes and found variations in PPVs ranging from below 15% to 100% [3]. A previous study examined 96 medical records for patients diagnosed with congenital epidermolysis bullosa. They concluded that the data should be used with caution based on a PPV of 62.5% [15].

This study showed a high validity of the diagnosis code of dislocation of the patella with a PPV of 96%. However, with the patient history being considered sufficient to make the diagnosis, it is difficult to say whether patients had an actual dislocation of the patella or not. One could argue that the diagnosis would be more certain if imaging such as MRI had been included as a diagnostic criterion. However, this would lead to an artificially low PPV as MRI is not performed routinely for this group of patients. Consequently, we opted for a relatively vague definition of this diagnosis, and therefore the PPV for patella dislocation might have been overestimated in this study.

The Achilles tendon diagnoses showed differences in validity with the diagnosis of acute Achilles tendon rupture having a PPV of 98% and the diagnosis of Achilles tendinitis having a PPV of 85%. One reason for the difference in PPV may be that acute Achilles tendon rupture is an acute injury with a clear onset and substantial loss of function, whereas Achilles tendinitis is a chronic injury with a slow onset and varying degrees of loss of function. A study investigating the utility of clinical measures for the diagnosis of Achilles tendon injuries found that the clinical measures for acute Achilles tendon rupture had stronger diagnostic accuracy properties than clinical measures investigating Achilles tendinitis [16], which could also explain the difference in PPV.

The diagnosis code for ACL rupture showed the highest of all validities in this study with a PPV of 98%. Most of

the patients with an ACL rupture in this study were diagnosed using MRI which has shown a PPV of nearly 100% in diagnosing ACL rupture [17].

When designing the study, it was difficult to decide on precise definitions of the diagnoses of traumatic tear of the meniscus and degenerative meniscal lesion. No consensus regarding the definition of these diagnoses has yet been established in the literature [11]. Sihvonen et al defined a degenerative meniscal tear as patients with persistent pain for more than three months with medial joint line tenderness of the knee and excluded patients with a trauma-induced onset of symptoms [18]. Beaufils et al defined a degenerative meniscal lesion as a meniscus lesion occurring without a history of a knee trauma in patients above the age of 35 years [13]. Due to the lack of clear definitions of the two diagnoses, we decided to investigate three different definitions based on: a trauma-based definition, a time-based definition and a problem-based definition. The results showed that the PPV for the trauma- and time-based criteria for both traumatic tear of meniscus and degenerative meniscal lesion were moderate to low, which was expected. However, the PPV for the problem-based definition for both diagnoses was expected to be higher because any form of lesion to the meniscus, regardless of its origin, was included in this definition.

Other studies have used age above 35 years as a diagnostic criterion for patients with degenerative meniscal lesions [11, 13, 18]. If age had been included as a criterion in this study, the PPV for the two diagnoses might have been different. Based on the results, the diagnosis codes for traumatic tear of the meniscus and degenerative meniscal lesion should not be used for distinguishing between the two injuries. The problem-based definition for the two meniscal injuries showed a moderate validity of 72% and 77%, respectively. Interpreting if a meniscal lesion is degenerative or traumatic is difficult, and the PPVs reflect that.

The two diagnosis codes have relatively low PPVs and can therefore be used in combination to address meniscal lesions in general without distinguishing whether the lesion is traumatic or degenerative. However, using the two diagnosis codes should be done with caution.

The study was limited by using diagnosis codes registered at one hospital only. The study was originally planned to take place at five different hospitals. However, due to implementation of the General Data Protection Regulation 2016/679 in the European Union in May 2018, it was impossible to access data from four of the five hospitals in the study period. The investigated department is a large orthopaedic department with subspecialised units within arthroscopic surgery and foot and ankle surgery. The specialised organisation of the department might affect the generalisability of the results to less specialised departments. The sample sizes for each of the diagnosis codes were reasonable, but no sample size calculation was performed. Additionally, it should be considered that the results of this type of study are sensitive to the definition of the diagnoses, meaning that more strict definition of diagnoses may lead to lower PPVs.

The strength of the study was that the patient records were investigated in one of the largest orthopaedic departments in Denmark. Many different doctors at different levels have registered the diagnosis codes making the results more generalisable.

CONCLUSIONS

This study documented an acceptable validity in the 85-98% range for the diagnosis codes for acute Achilles tendon rupture, Achilles tendinitis, rupture of the ACL of the knee and dislocation of the patella investigated in the DNPR. This implies that the codes may be used for epidemiological research within the field. The diagnosis codes for traumatic tear of the meniscus and degenerative meniscal lesion showed a lower validity falling in the 53-77% range, and thus caution should be taken when using these.

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