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PREDICTIVE FACTORS ASSOCIATED WITH INCREASED RISK OF MENISCAL TEARS AND CHONDRAL LESIONS IN ANTERIOR CRUCIATE LIGAMENT TEAR PATIENTS

Orthopaedics

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ABSTRACT

INTRODUCTION: ACL injury predisposes the knee to additional damages.
AIM: To find the predictors of meniscal and chondral injuries in patients of ACL tear.
DESIGN: retrospective study.
MATERIALS AND METHODS: Data were acquired from 1200 patients undergoing ACL reconstruction. Logistic regression assessed the association between potential predictive factors and presence of meniscal and chondral lesions in ACL deficient knees.
RESULTS: number of instability episodes(OR=1.191, p<0.0001), time since injury(OR=1.004, p=0.001), Sports related injury(OR=1.471, p=0.010) and high velocity injury like RTA(OR= 2.144, p<0.0001) predicted meniscal tears. Time since injury(OR=1.007, p<0.0001), age(OR=1.032, p=0.004), number of instability episodes(OR=1.092, p<0.0001) and previous knee surgery(OR=2.681, p=0.028) predicted chondral lesions.
CONCLUSIONS: Higher number of instability episodes, delayed time since injury, Sports related injury and high velocity injury predicts meniscal tears. Time since injury, age, number of instability episodes and previous ipsilateral arthroscopic knee surgery predicts chondral lesions in ACL deficient knees.

KEYWORDS

ACL; meniscus; chondral.

INTRODUCTION

ACL is the primary stabilizer of knee join. Nearly half of the ACL injured patients have meniscal tears and around 30% have chondral injuries[1-6]. These additional injuries in ACL patients may be associated with high chance of development of osteoarthritis as compared to patients with isolated ACL tear[7,8].

Various factors have been reported to be associated with the occurrence of these additional injuries in ACL patients, like time since injury[3,4,9,10], age[4], body mass index or BMI[11], gender, activity level before and after injury[4,12-13], number of instability episodes[14,15], history of previous ipsilateral knee surgery[16] etc. The relation of some of these factors with associated meniscal and chondral injuries has been assessed by some studies, but with conflicting results[4,17-20] . Many of these factors like time since injury, activity level after injury and no. of instability episodes are modifiable and may be etiologically related to these injuries, and it is also important to know the non- modifiable factors.

Understanding the associations of various factors with these additional injuries can have a role in prevention, treatment and prognosis of the patients.

The purpose of this study was to assess the incidence of associated meniscal and chondral injuries in patients with ACL tear and to find the predictors of these injuries in ACL tear patients.

MATERIAL AND METHODS

The data for this study were obtained from combined retrospective and prospective evaluation of 1200 patients with diagnosed complete ACL tear planned for ACL reconstruction at a dedicated sports injury centre. The data on factors being assessed like time since injury, age, BMI, gender, number of instability episodes, mechanism of injury, activity level before injury, activity level after injury, side of ACL injury and previous arthroscopic ipsilateral knee surgery were collected retrospectively, and the presence or absence of additional injuries was confirmed during the arthroscopic ACL surgery prospectively.

Prior approval from the Institutional Ethics Committee was obtained before the start of the study (S.No. IEC/VMMC/SJH/Thesis/October - 2015).

Patients above 15yrs of age with complete ACL tear with or without any documented meniscal or chondral injury and planning to undergo an ACL reconstruction were included in the study. Patients with multiligamentous knee injury, revision ACL reconstruction, ACL avulsion injury and with ligamentous hyperlaxity were excluded from study.

STATISTICAL ANALYSES

Descriptive statistics were calculated for demographic and arthroscopic findings(*Table 1*). Incidences of meniscal and chondral lesions were calculated separately. Multivariate logistic regression was used for both meniscal and chondral lesions separately to determine whether these predefined factors were related to meniscal and chondral lesions in ACL deficient knee. Odds ratio(OR) and their corresponding 95% Confidence interval (95%CI) were calculated for each predictive variable with respect to meniscal tears and chondral lesions. Statistical significance was kept at p=0.05.

RESULTS

The study population consisted of 1107 males and 93 females (*Table 1*). Majority of patients (43%) got operated between 3months to 1year from injury. At least 1 meniscal or cartilage lesion was observed at the time of ACL reconstruction in 780 patients out of 1200 (65%).

Meniscal injuries were present in 684 patients(57%) . Amongst these patients, 419 had medial meniscus tear, 389 had lateral meniscus tear and 124 had both medial and lateral meniscus tear. Cartilage lesions were seen in 297 patients(24.75%). The lesion was present on femur in 252 patients, whereas 61 and 74 patients had chondral lesions on tibia and patella respectively. 29 patients had global chondral lesions noted at the time of ACL reconstruction.

These predefined factors were assessed for their predictive relevance with respect to meniscal tears and chondral lesions in ACL tear patients (*Table 2*).

TABLE 1: Sample Characteristics (N=1200)

S.No.		Type of variable	
1.	**Time since injury(weeks)** Median Inter quartile range	Continuous	 26 8-67.5
2.	**Age(years)** Median Inter quartile range	Continuous	 27 22-33
3.	**BMI(kg/m^2)** Median Inter quartile range	Continuous	 23.9 22.49-25.50
4.	**Gender** Male Female	Categorical	 1107(92.25%) 93(7.75%)
5.	**Mechanism of injury** Low velocity injury Sports related injury High velocity injury	Categorical	 356(29.67%) 564(47%) 280(23.33%)
6.	**Activity level before injury** Very strenuous Strenuous Moderate Light	Categorical	 247(20.58%) 435(36.25%) 453(37.75%) 65(5.42%)
7.	**Activity level after injury** Very strenuous Strenuous Moderate Light Unable to perform any activity	Categorical	 3(0.25%) 12(1%) 133(11.08%) 988(82.33%) 64(5.33%)
8.	**No. of instability episodes** Median Inter quartile range	Continuous	 5 3-8
9.	**Side of ACL injury** Right Left	Categorical	 657(54.75%) 543(45.25%)
10.	**Previous knee surgery** Present Absent	Categorical	 26(2.17%) 1174(97.83%)

TABLE 2: Meniscal and chondral injury predictors in patients of ACL tear (N=1200)

S.No.	Characteristics	Meniscal Tears		Chondral Lesions	
		Odds Ratio (95% CI)	p value	Odds Ratio (95% CI)	p value
1.	**Time since injury**	1.004 (1.002-1.006)	0.001	1.007 (1.005-1.009)	<0.0001
2.	**Age**	1.012 (0.998-1.026)	0.083	1.032 (1.010-1.055)	0.004
3.	**BMI**	1.026 (0.978-1.077)	0.287	1.005 (0.948-1.065)	0.874
4.	Gender Male Female	 1.00(referent) 0.909 (0.594-1.391)	0.661	1.00(referent) 1.608 (0.950-2.720)	0.077
5.	Mechanism of injury Low velocity injury Sports related injury High velocity injury	 1.00(referent) 1.471 (1.095-1.976) 2.144 (1.498-3.067)	0.010 <0.0001	 1.00(referent) 0.571 (0.379-0.862) 1.213 (0.826-1.781)	0.008 0.325
6.	Activity level before injury Very strenuous Strenuous Moderate Light	1.254 (0.724-2.169) 1.232 (0.731-2.078) 1.196 (0.710-2.013) 1.00(referent)	0.419 0.434 0.502	1.774 (0.813-3.872) 1.483 (0.736-2.988) 1.433 (0.747-2.749) 1.00(referent)	0.150 0.271 0.279
7.	Activity level after injury Very strenuous Strenuous Moderate Light Unable to perform any activity	1.122 (0.96-13.056) 2.805 (0.565-13.917) 0.623 (0.337-0.1.151) 0.737 (0.436-1.247) 1.00(referent)	 0.927 0.207 0.131 0.255	0.756 (0.011-49.790) 0.567 (0.128-2.516) 0.385 (0.170-0.874) 0.506 (0.269-0.950) 1.00(referent)	0.896 0.456 0.022 0.034
8.	No. of instability episodes	1.191 (1.144-1.241)	<0.0001	1.092 (1.056-1.130)	<0.0001
9.	Side of ACL injury Right Left	 1.00(referent) 0.866 (0.688-1.089)	0.218	1.00(referent) 0.843 (0.647-1.099)	0.207
10.	Previous I/L knee surgery	0.546 (0.249-1.199)	0.131	2.681 (1.115-6.445)	0.028

Time since injury to surgery was found to be significantly associated with the presence of meniscal tears, for every one week delay in surgery, the odds of finding a meniscal injury increased by 0.4%. It was also associated with increased risk of chondral lesions, for each one week delay odds of finding a chondral lesion increased by 0.7% Higher number of instability episodes was also associated with higher risk of additional meniscal and chondral lesion. Age at injury did not affect additional meniscal tears in ACL deficient knee but it did predicted chondral lesion. For every 1year increase in age of the patient at the time of injury, there was around 3% increase in incidence of

articular cartilage lesion.

Out of 1200 patients, 26 had history of previous knee surgery. Risk of meniscus injury observed at the time of surgery was not significantly different in these patients .However, risk of chondral lesions observed was significantly higher in them.

Sports related injury and high velocity injury like RTA predicted additional meniscal tear in an ACL deficient knee as compared to low velocity injuries. Activity level after injury did not predicted meniscal tears. However, moderate and light level of activity after injury did predicted chondral lesions as compared to those with no activity.

Gender, BMI, side of injury and activity level before and after injury were not found to be associated with either meniscal or chondral lesions, after removal of confounding factors.

DISCUSSION

The incidence of meniscal injuries in our study was 57% . The meniscal injury in ACL tear patients observed in previous studies varies from 22% to 86% [3,4,9,10,12,18,21]. The overall incidence of articular cartilage lesion in our study was 24.75%, similar to the rates reported in previous studies (11% to 43%)[4,21].

The average delay between injury and surgery has been reported in various studies to vary from 14weeks-156weeks[3,4,9,10,12,18,21]. Previous studies have supported the fact that with delay in time since injury, chances of finding a meniscal or cartilage lesion increases[3,4,9,10]. In our study, almost 30% patients had received surgery within 3 months of injury. The time since injury was found to significantly predicts the risk of meniscal tears and chondral lesions in ACL tear patients.

Previous studies have shown that patient's age is associated with the presence of chondral injuries but not with meniscal tears in ACL tear patients[14,22]. In our study also, risk of meniscal injury was not related to age but chondral lesion in ACL deficient knee was very much predicted by age of the individual.

Men have been reported to have a consistently higher occurrence rate of meniscal injuries than the women[14,22]. Results on cartilage lesion are conflicting. Some studies found that male sex predicted chondral lesion[16], while another study mentioned no association of gender with presence of chondral lesions[22]. In contrast, our study found that the risk of meniscus injury and chondral lesions were not related to the gender.

BMI have been reported to predict both meniscal and chondral lesions in an ACL deficient knee[11,14]. In our study also, after removal of confounding factors in multivariate logistic regression, BMI was not found to be associated with any additional injuries.

Previous studies reported higher incidence of meniscal tears in patients with higher number of instability episodes but results are conflicting regarding chondral lesions[14,15]. In our study, number of instability episodes significantly predicted risk of both meniscal tear as well as chondral lesions.

Previous studies have found mechanism of injury to predict meniscal tears but not chondral lesions[14,19]. Our study found that sports related injury and high velocity injuries like RTA had higher risk of meniscal tear than low velocity injury like fall. It was also seen that sports related injuries were associated with less risk of chondral lesions than low velocity injury.

Previous studies reported that level of sports post ACL injury did not statistically predicted meniscal or chondral lesions[4].In our study, level of activity post ACL injury did not predict any additional meniscal injuries but an association with articular cartilage damage was found. Individuals who were able to pursue light and moderate activities after injury were found to have less chondral damage as compared to the individuals who were not able to perform any activity post injury.

In our study history of previous ipsilateral knee surgery did not predict additional meniscal injury, but did significantly predicted chondral lesion in ACL tear patients. The literature for influence of previous surgery on the risk of chondral lesions is conflicting. A few studies reported that the number of instability episodes predicts chondral lesions[18], while some did not.[22]

It is significant to mention that there is no other study available in this context in Indian scenario. It is an extensive study with large sample size of 1200. In our study, the confirmation of complete ACL tear and meniscal and chondral findings was done in all patients by MRI and also by arthroscopic visualization of knee.

Our study has its own limitations. Like in case of any retrospective data collection, it cannot be commented whether the meniscal and chondral injury was present prior to ACL injury or occured at the time of injury or after the ACL tear. Recall bias also becomes important for factors like mechanism of injury or number of instability episodes suffered since injury.

The modifiable factors associated with additional injuries are time since injury and number of instability episodes and should be modified in order to minimize the chances of additional damage in an ACL deficient knee.

CONCLUSION

In patients of ACL tear, increased time since injury and number of instability episodes was associated with higher incidence of both the meniscal and chondral injuries. Mechanism of injury like sports related injury and high velocity injury also predicted more meniscal tears. Increased age at the time of injury and history of previous ipsilateral arthroscopic knee surgery was associated with higher chances of chondral injuries.

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